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(54) **DEVICE, METHOD, AND GRAPHICAL USER INTERFACE WITH A DYNAMIC GESTURE DISAMBIGUATION THRESHOLD**

(75) Inventors: **Charles J. Migos**, San Bruno, CA (US); **Britt S. Miura**, Menlo Park, CA (US); **Akiva D. Leffert**, San Francisco, CA (US)

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

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CPC ***G06F 3/04883*** (2013.01); ***G06F 17/241*** (2013.01); *G06F 2203/04808* (2013.01)

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Primary Examiner — Cong-Lac Huynh
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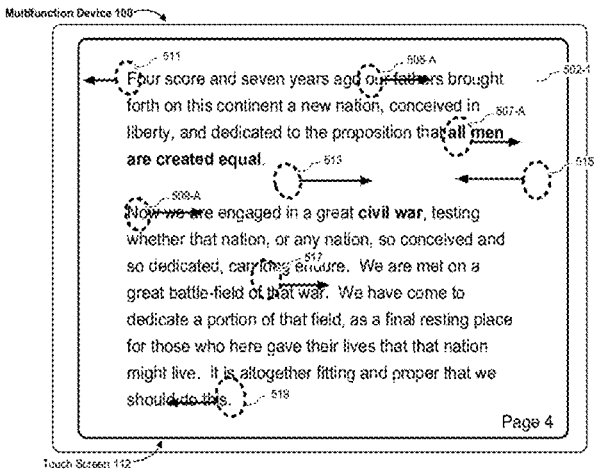
(57) **ABSTRACT**

An electronic device with a display, a touch-sensitive surface, one or more processors, and memory detects a first portion of a gesture, and determines that the first portion has a first gesture characteristic. The device selects a dynamic disambiguation threshold in accordance with the first gesture characteristic. The dynamic disambiguation threshold is used to determine whether to perform a first type of operation or a second type of operation when a first kind of gesture is detected. The device determines that the gesture is of the first kind of gesture. After selecting the dynamic disambiguation threshold, the device determines whether the gesture meets the dynamic disambiguation threshold. When the gesture meets the dynamic disambiguation threshold, the device performs the first type of operation, and when the gesture does not meet the dynamic disambiguation threshold, the device performs the second type of operation.

4 Claims, 17 Drawing Sheets



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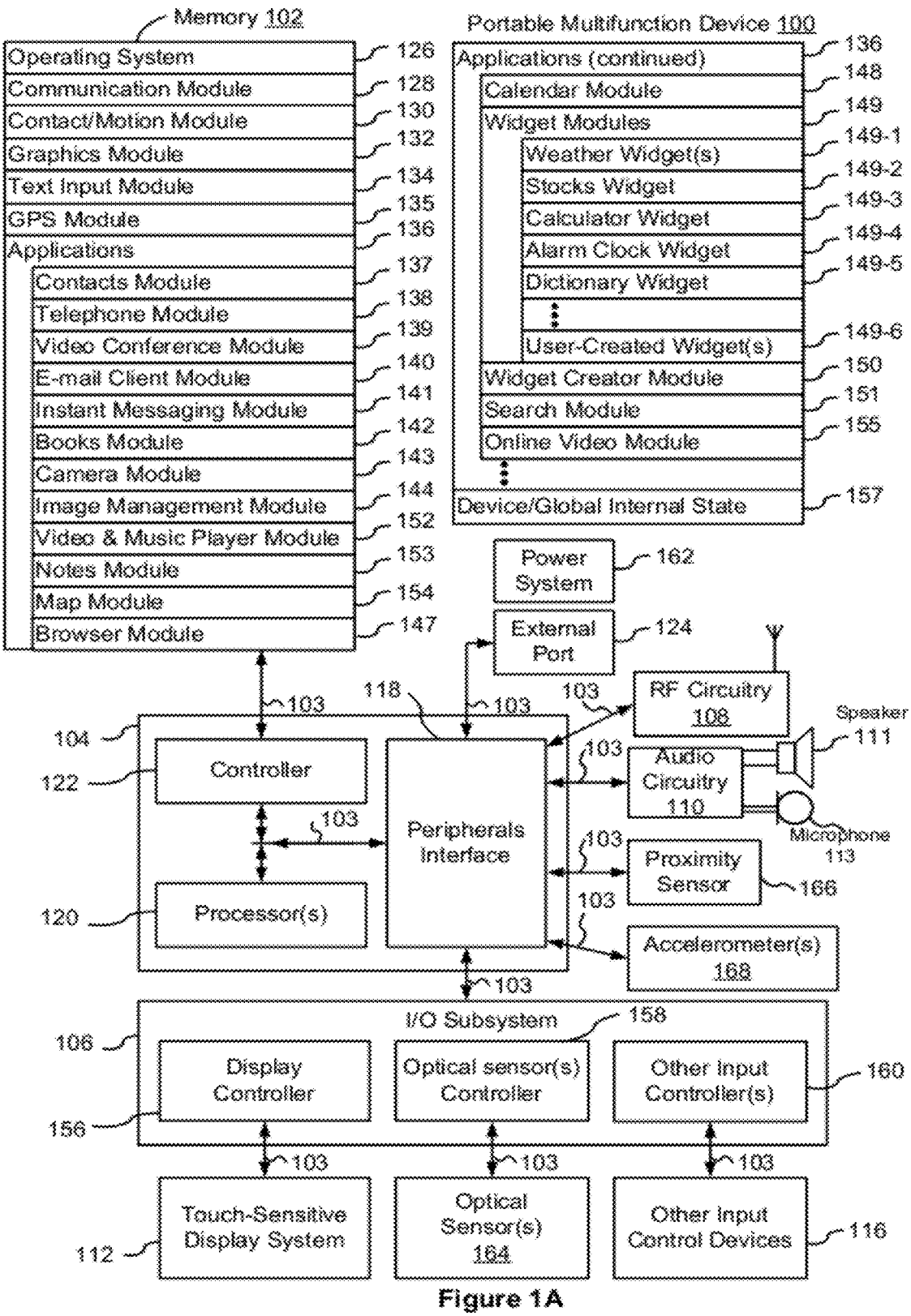
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141
Books Module
142
Camera Module
143
Image Management Module
144
Video & Music Player Module
152
Notes Module
153
Map Module
154
Browser Module
147
Portable Multifunction Device 100
Applications (continued)
136
Calendar Module
148
Widget Modules
149
Weather Widget(s)
149-1
Stocks Widget
149-2
Calculator Widget
149-3
Alarm Clock Widget
149-4
Dictionary Widget
149-5
User-Created Widget(s)
149-6
Widget Creator Module
150
Search Module
151
Online Video Module
155
Device/Global Internal State
157
Power System
162
External Port
124
RF Circuitry 108
Speaker 111
Audio Circuitry 110
Microphone 113
Proximity Sensor
166
Accelerometer(s) 168
Peripherals Interface
Controller
Processor(s)
104
122
120
118
103
I/O Subsystem
158
Display Controller
Optical sensor(s) Controller
Other Input Controller(s)
160
106
156
Touch-Sensitive Display System
112
Optical Sensor(s) 164
Other Input Control Devices
116

Figure 1A

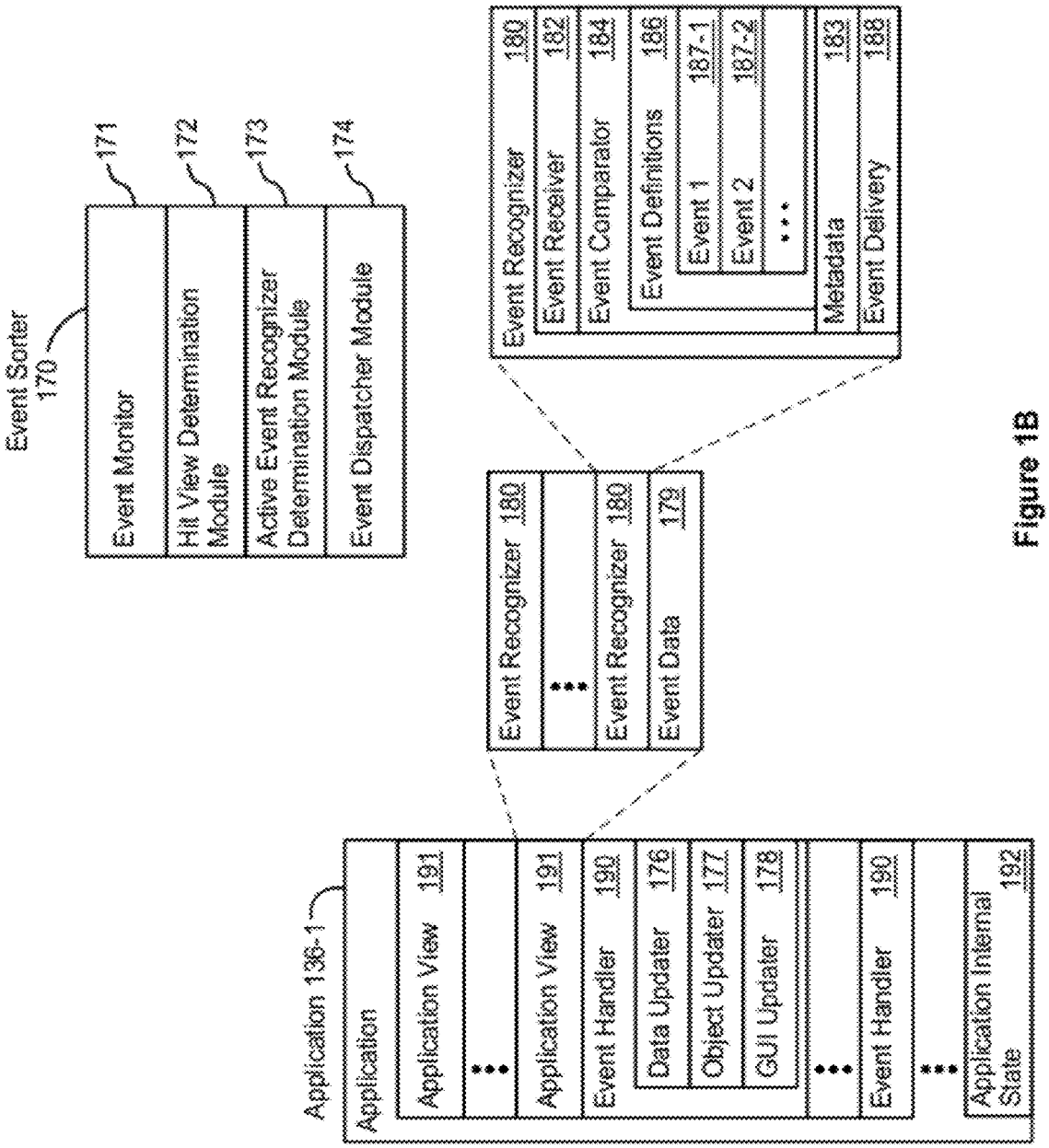

Event Sorter 170
171
Event Monitor
172
Hit View Determination Module
173
Active Event Recognizer Determination Module
174
Event Dispatcher Module
Application 136-1
Application
Application View 191
...
Application View 191
Event Handler 190
Data Updater 176
Object Updater 177
GUI Updater 178
...
Event Handler 190
...
Application Internal State 192
Event Recognizer 180
...
Event Recognizer 180
Event Data 179
Event Recognizer 180
Event Receiver 182
Event Comparator 184
Event Definitions 186
Event 1 187-1
Event 2 187-2
...
Metadata 183
Event Delivery 188

Figure 1B

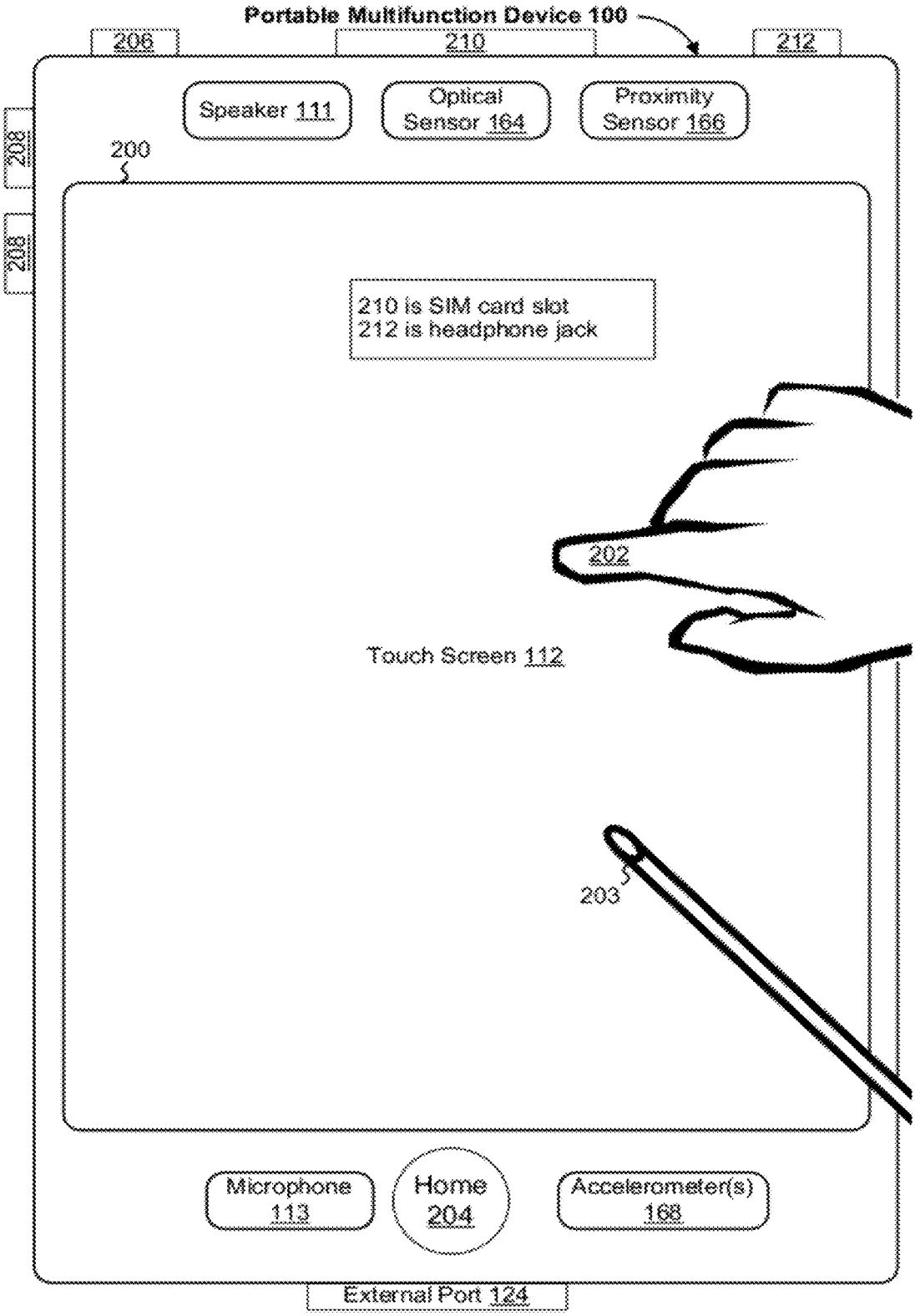

Portable Multifunction Device 100
206
210
212
Speaker 111
Optical Sensor 164
Proximity Sensor 166
208
200
204
210 is SIM card slot
212 is headphone jack
202
Touch Screen 112
203
Microphone 113
Home 204
Accelerometer(s) 168
External Port 124

Figure 2

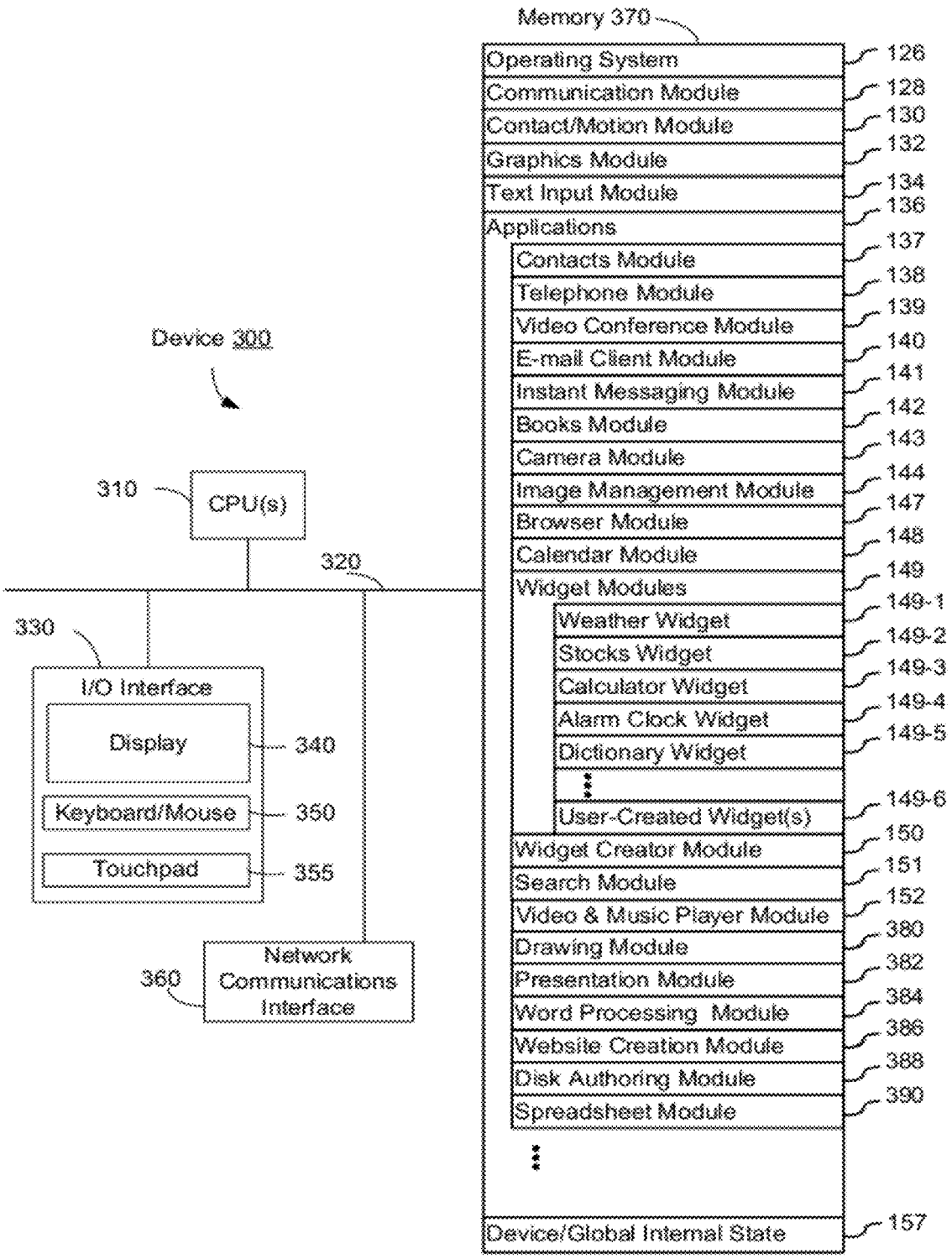

Memory 370
Operating System
126
Communication Module
128
Contact/Motion Module
130
Graphics Module
132
Text Input Module
134
Applications
136
Contacts Module
137
Telephone Module
138
Video Conference Module
139
E-mail Client Module
140
Instant Messaging Module
141
Books Module
142
Camera Module
143
Image Management Module
144
Browser Module
147
Calendar Module
148
Widget Modules
149
Weather Widget
149-1
Stocks Widget
149-2
Calculator Widget
149-3
Alarm Clock Widget
149-4
Dictionary Widget
149-5
User-Created Widget(s)
149-6
Widget Creator Module
150
Search Module
151
Video & Music Player Module
152
Drawing Module
380
Presentation Module
382
Word Processing Module
384
Website Creation Module
386
Disk Authoring Module
388
Spreadsheet Module
390
Device/Global Internal State
157
Device 300
310
CPU(s)
320
330
I/O Interface
Display
340
Keyboard/Mouse
350
Touchpad
355
360
Network Communications Interface

Figure 3

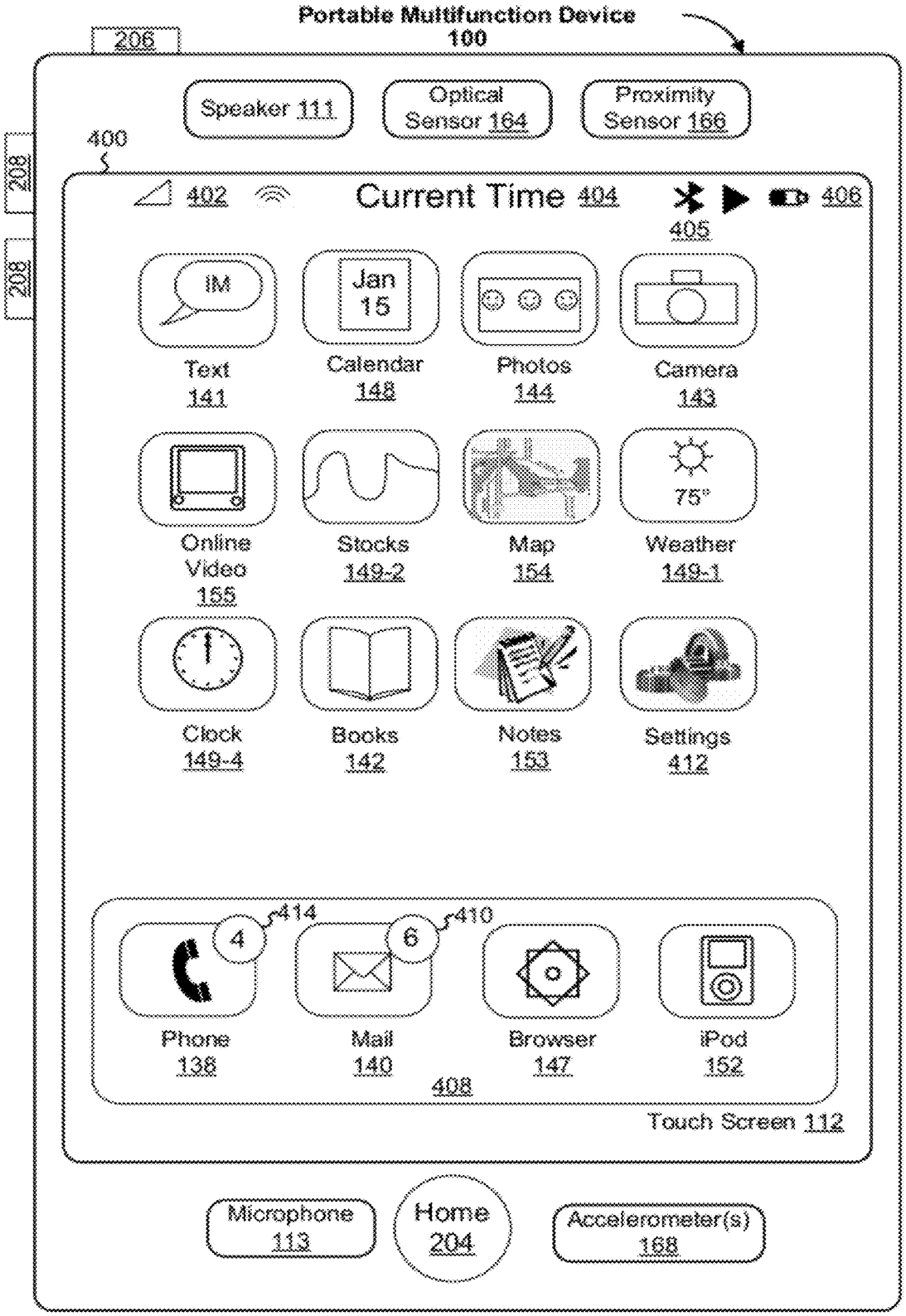
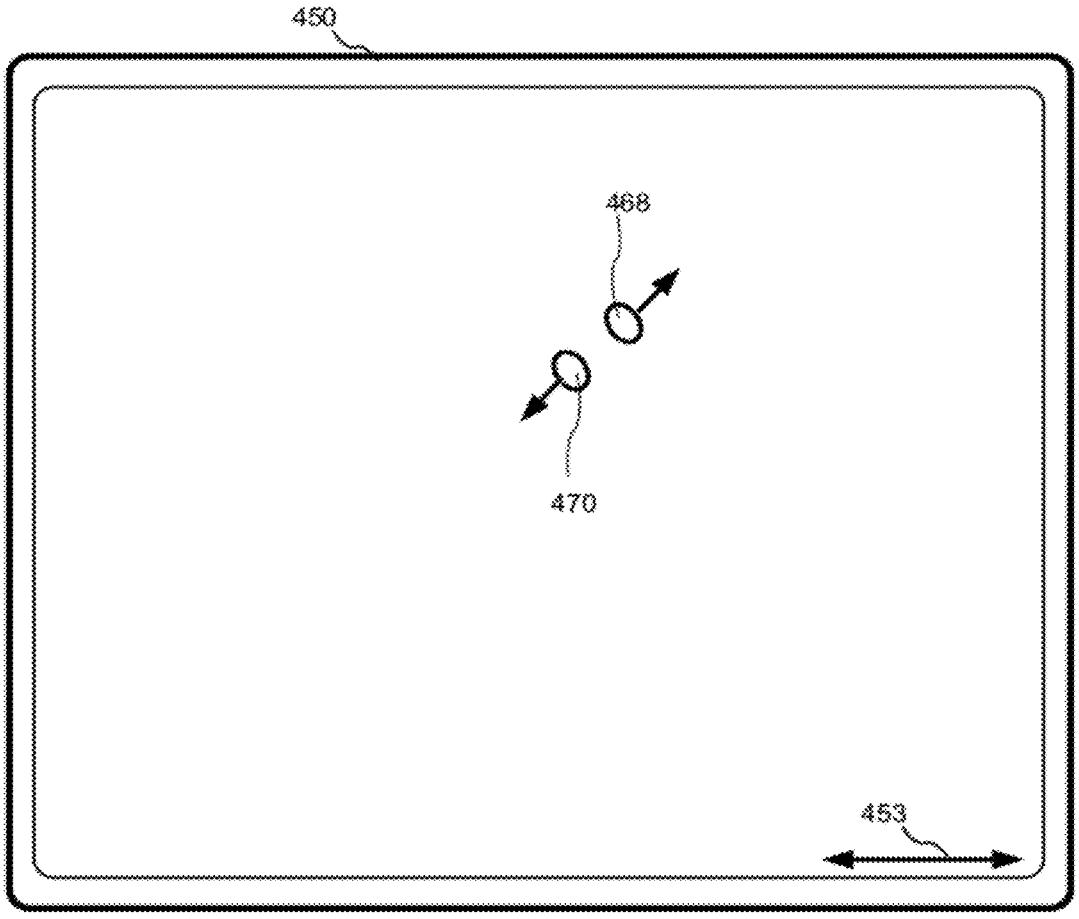

Portable Multifunction Device
100
206
Speaker 111
Optical Sensor 164
Proximity Sensor 166
400
202
204
208
208
402
Current Time 404
406
405
IM
Text 141
Jan 15
Calendar 148
Photos 144
Camera 143
Online Video 155
Stocks 149-2
Map 154
75°
Weather 149-1
Clock 149-4
Books 142
Notes 153
Settings 412
414
4
410
6
Phone 138
Mail 140
Browser 147
iPod 152
408
Touch Screen 112
Microphone 113
Home 204
Accelerometer(s) 168

Figure 4A



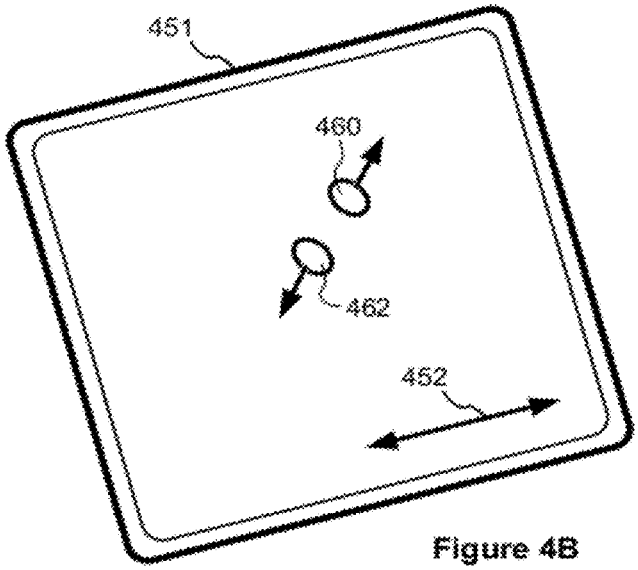


Figure 4B

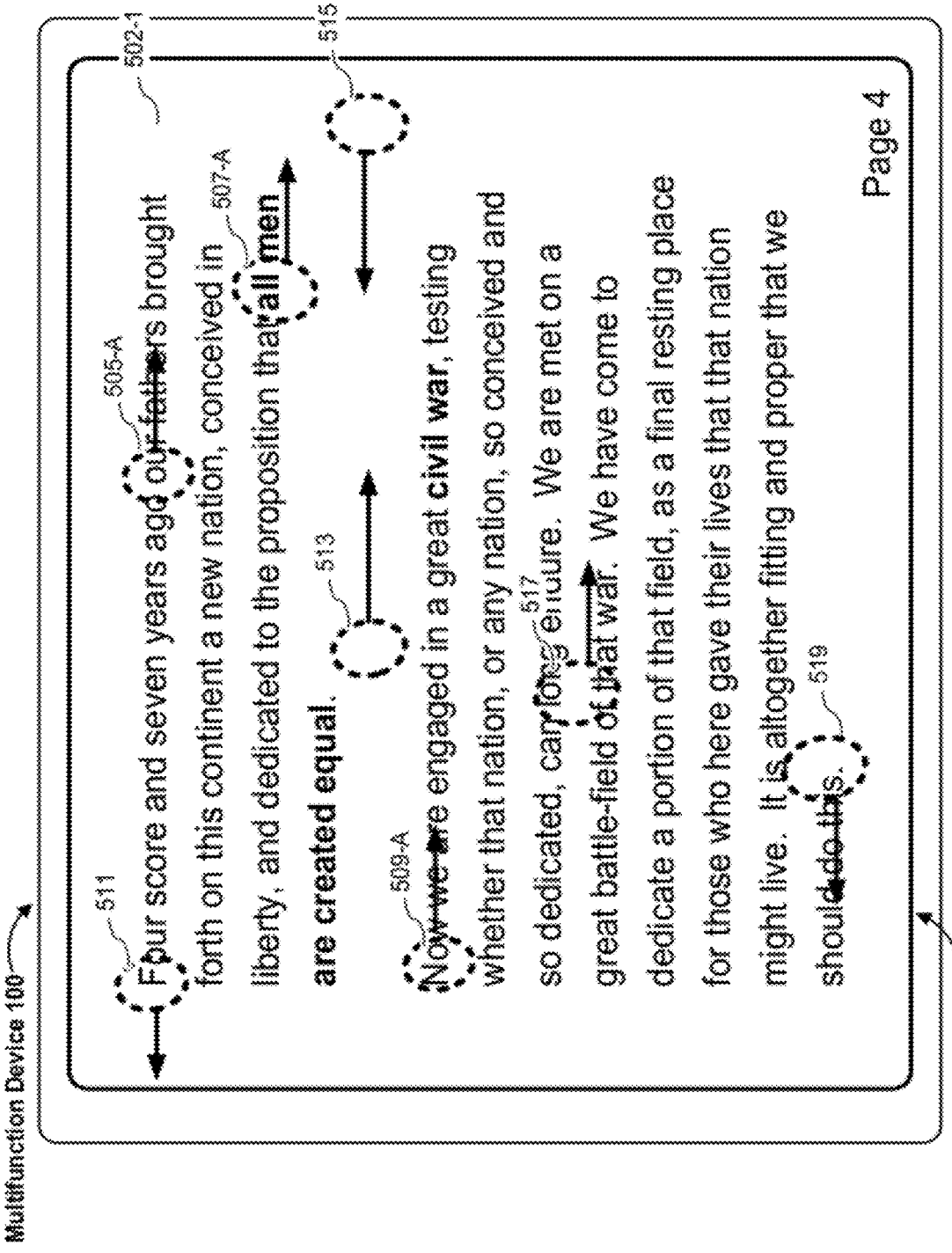

Multifunction Device 100
Touch Screen 112
502-1
511
505-A
507-A
515
513
509-A
517
519
Four score and seven years ago our fathers brought forth on this continent a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal.
Now we are engaged in a great civil war, testing whether that nation, or any nation, so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.
Page 4

Figure 5A

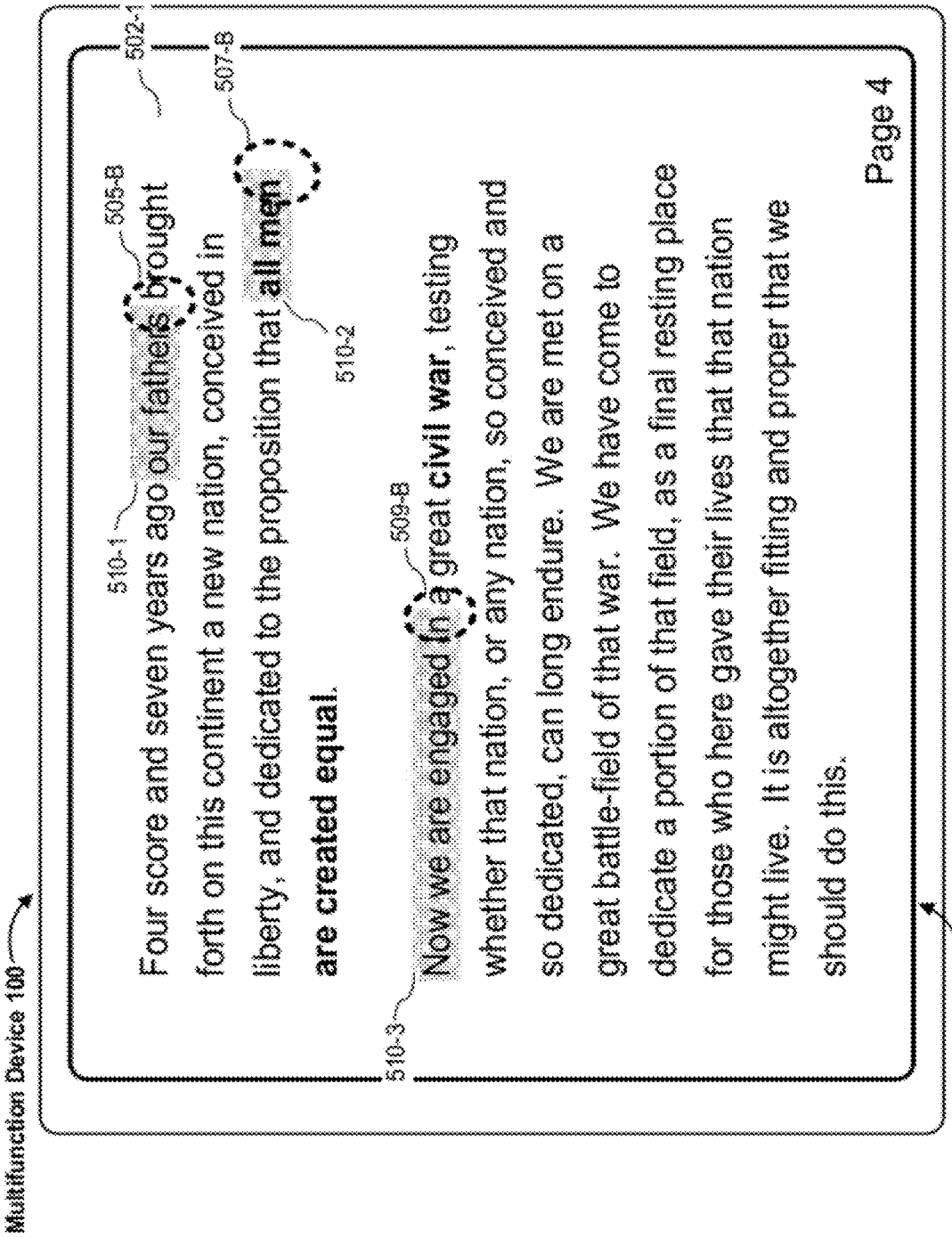

Multifunction Device 100
Touch Screen 112
502-1
505-B
507-B
509-B
510-1
510-2
510-3
Four score and seven years ago our fathers brought forth on this continent a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal.
Now we are engaged in a great civil war, testing whether that nation, or any nation, so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.
Page 4

Figure 5B

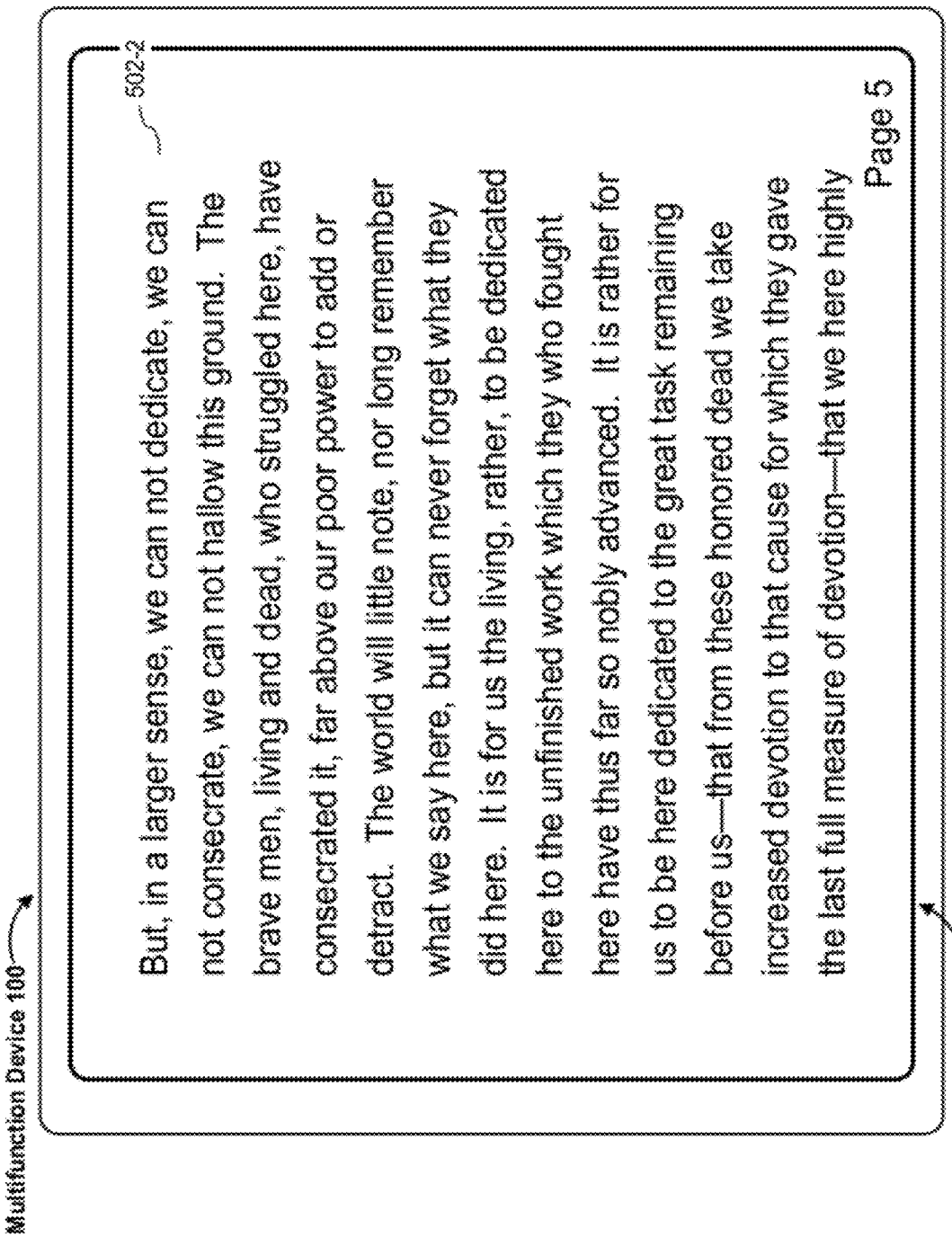

Multifunction Device 100
502-2
But, in a larger sense, we can not dedicate, we can not consecrate, we can not hallow this ground. The brave men, living and dead, who struggled here, have consecrated it, far above our poor power to add or detract. The world will little note, nor long remember what we say here, but it can never forget what they did here. It is for us the living, rather, to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us—that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion—that we here highly
Page 5
Touch Screen 112

Figure 5C

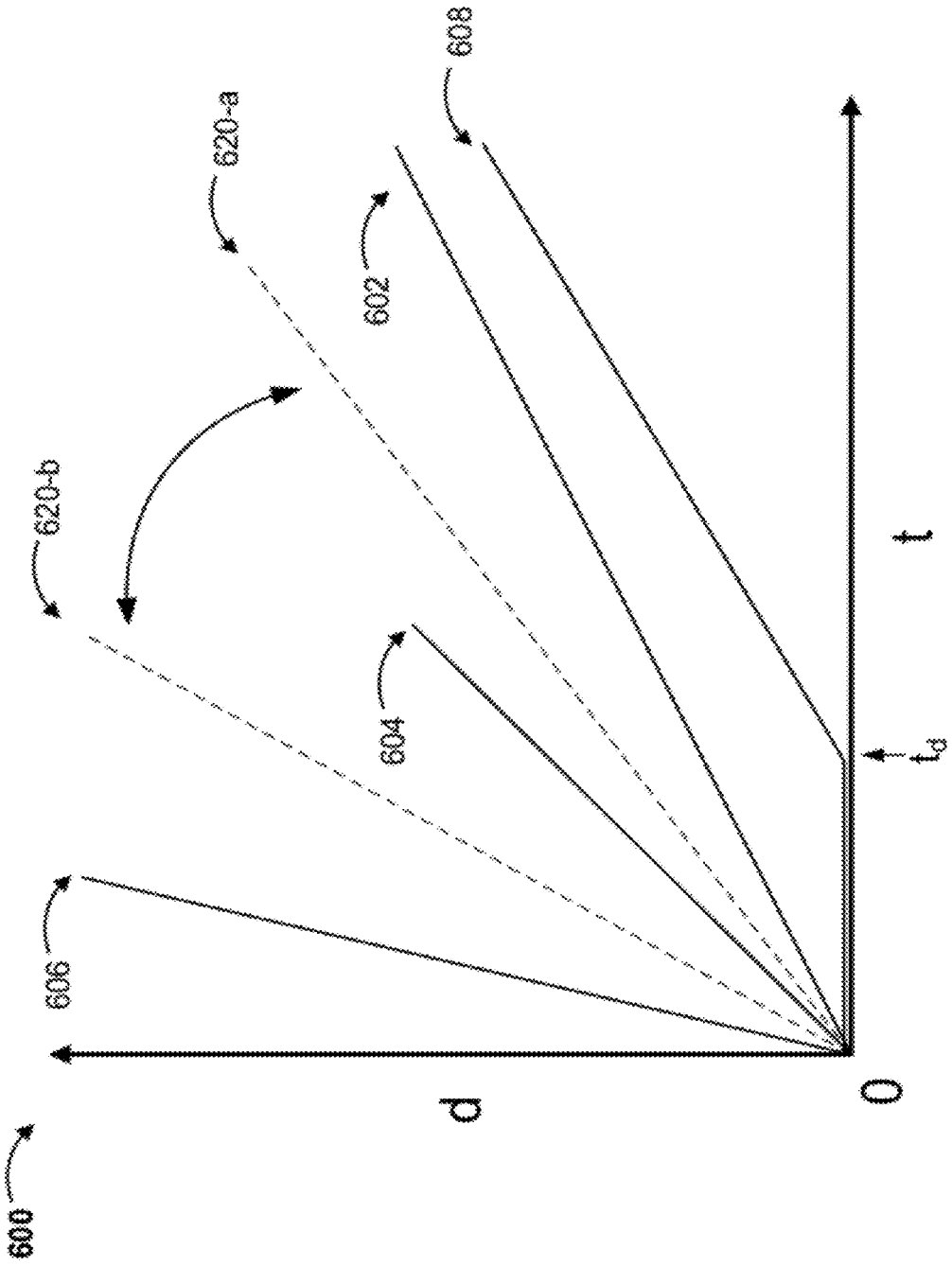


Figure 6

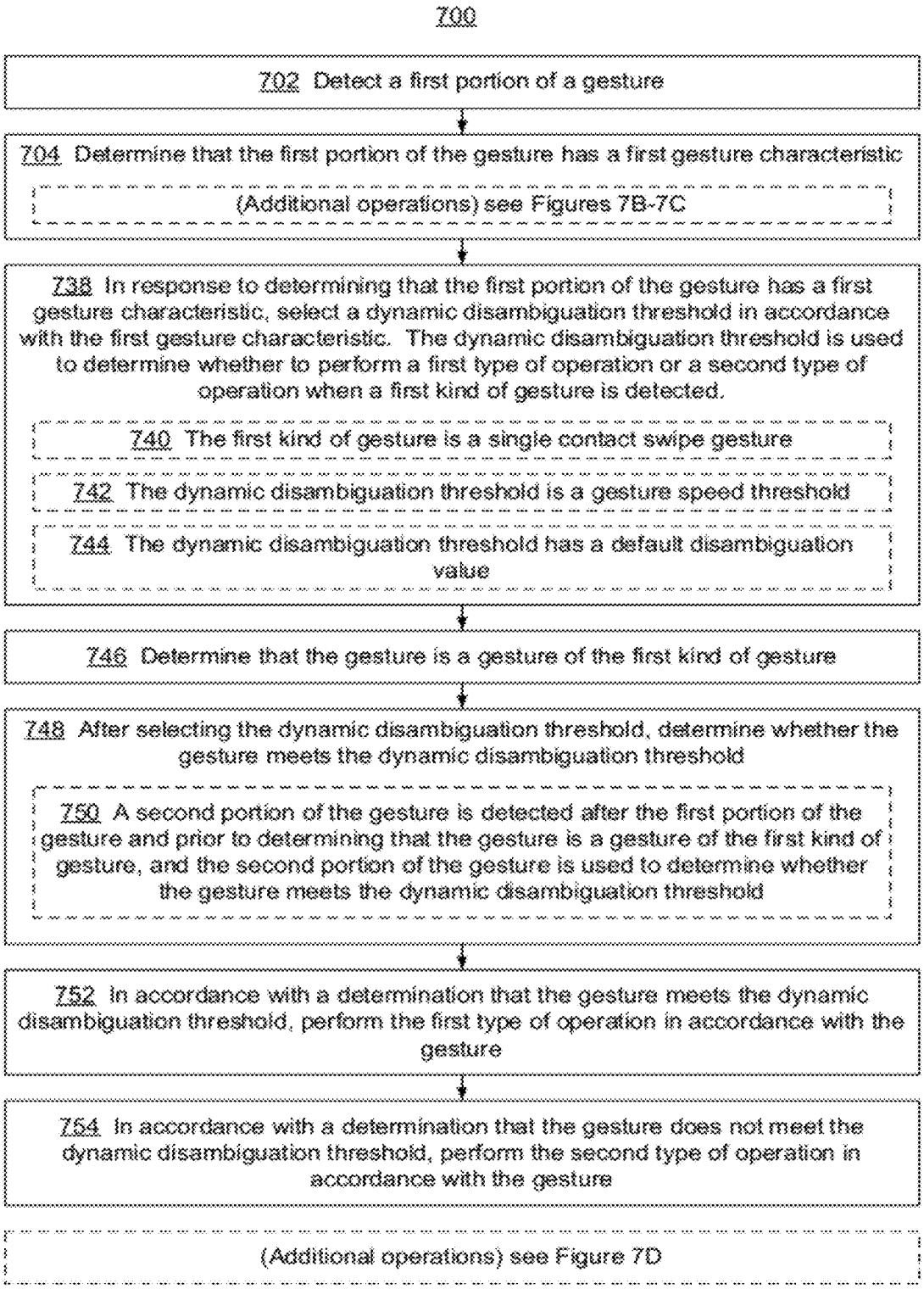

700
702 Detect a first portion of a gesture
704 Determine that the first portion of the gesture has a first gesture characteristic
(Additional operations) see Figures 7B-7C
738 In response to determining that the first portion of the gesture has a first gesture characteristic, select a dynamic disambiguation threshold in accordance with the first gesture characteristic. The dynamic disambiguation threshold is used to determine whether to perform a first type of operation or a second type of operation when a first kind of gesture is detected.
740 The first kind of gesture is a single contact swipe gesture
742 The dynamic disambiguation threshold is a gesture speed threshold
744 The dynamic disambiguation threshold has a default disambiguation value
746 Determine that the gesture is a gesture of the first kind of gesture
748 After selecting the dynamic disambiguation threshold, determine whether the gesture meets the dynamic disambiguation threshold
750 A second portion of the gesture is detected after the first portion of the gesture and prior to determining that the gesture is a gesture of the first kind of gesture, and the second portion of the gesture is used to determine whether the gesture meets the dynamic disambiguation threshold
752 In accordance with a determination that the gesture meets the dynamic disambiguation threshold, perform the first type of operation in accordance with the gesture
754 In accordance with a determination that the gesture does not meet the dynamic disambiguation threshold, perform the second type of operation in accordance with the gesture
(Additional operations) see Figure 7D

Figure 7A

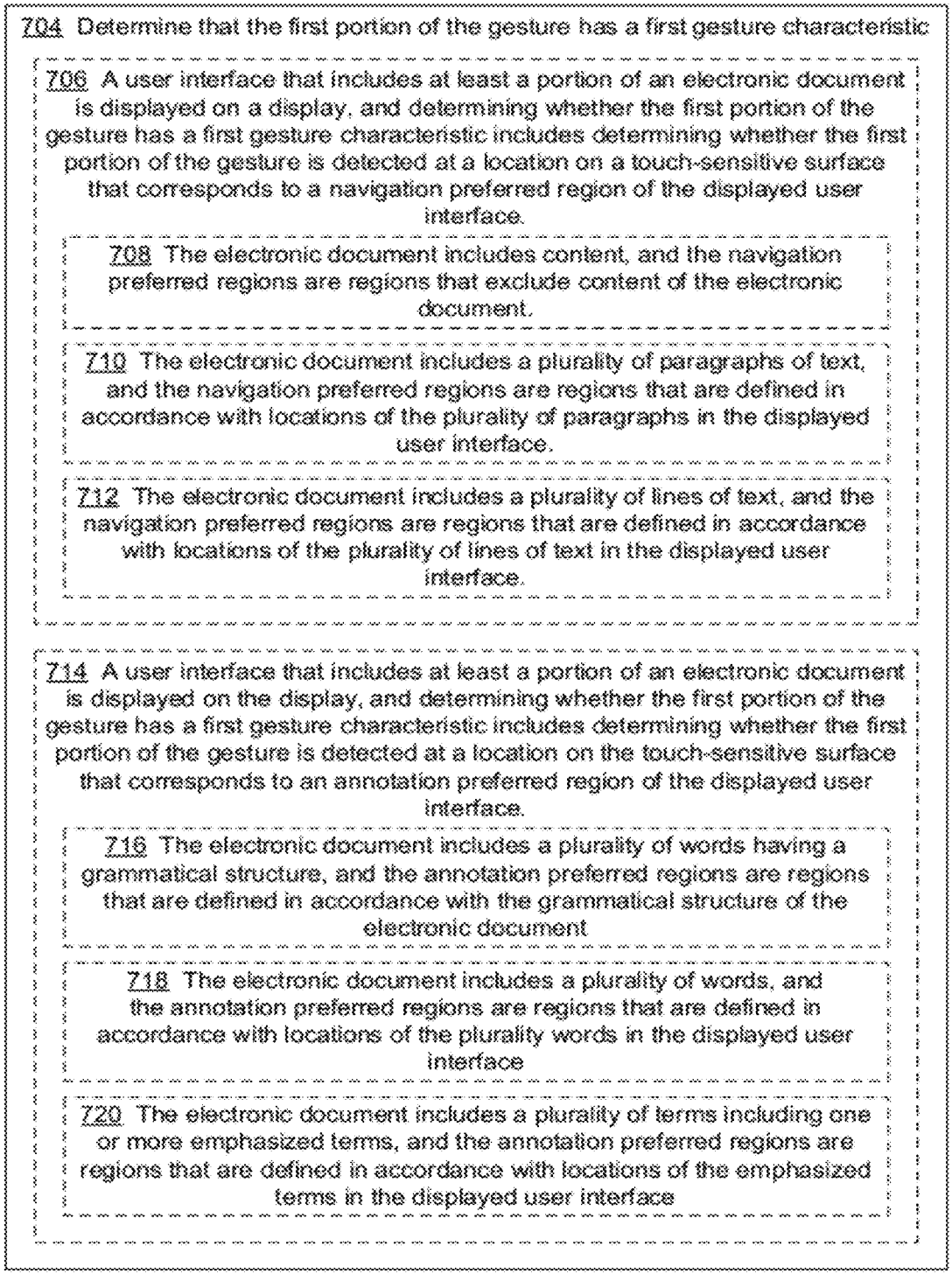

704 Determine that the first portion of the gesture has a first gesture characteristic
706 A user interface that includes at least a portion of an electronic document is displayed on a display, and determining whether the first portion of the gesture has a first gesture characteristic includes determining whether the first portion of the gesture is detected at a location on a touch-sensitive surface that corresponds to a navigation preferred region of the displayed user interface.
708 The electronic document includes content, and the navigation preferred regions are regions that exclude content of the electronic document.
710 The electronic document includes a plurality of paragraphs of text, and the navigation preferred regions are regions that are defined in accordance with locations of the plurality of paragraphs in the displayed user interface.
712 The electronic document includes a plurality of lines of text, and the navigation preferred regions are regions that are defined in accordance with locations of the plurality of lines of text in the displayed user interface.
714 A user interface that includes at least a portion of an electronic document is displayed on the display, and determining whether the first portion of the gesture has a first gesture characteristic includes determining whether the first portion of the gesture is detected at a location on the touch-sensitive surface that corresponds to an annotation preferred region of the displayed user interface.
716 The electronic document includes a plurality of words having a grammatical structure, and the annotation preferred regions are regions that are defined in accordance with the grammatical structure of the electronic document
718 The electronic document includes a plurality of words, and the annotation preferred regions are regions that are defined in accordance with locations of the plurality words in the displayed user interface
720 The electronic document includes a plurality of terms including one or more emphasized terms, and the annotation preferred regions are regions that are defined in accordance with locations of the emphasized terms in the displayed user interface

Figure 7B

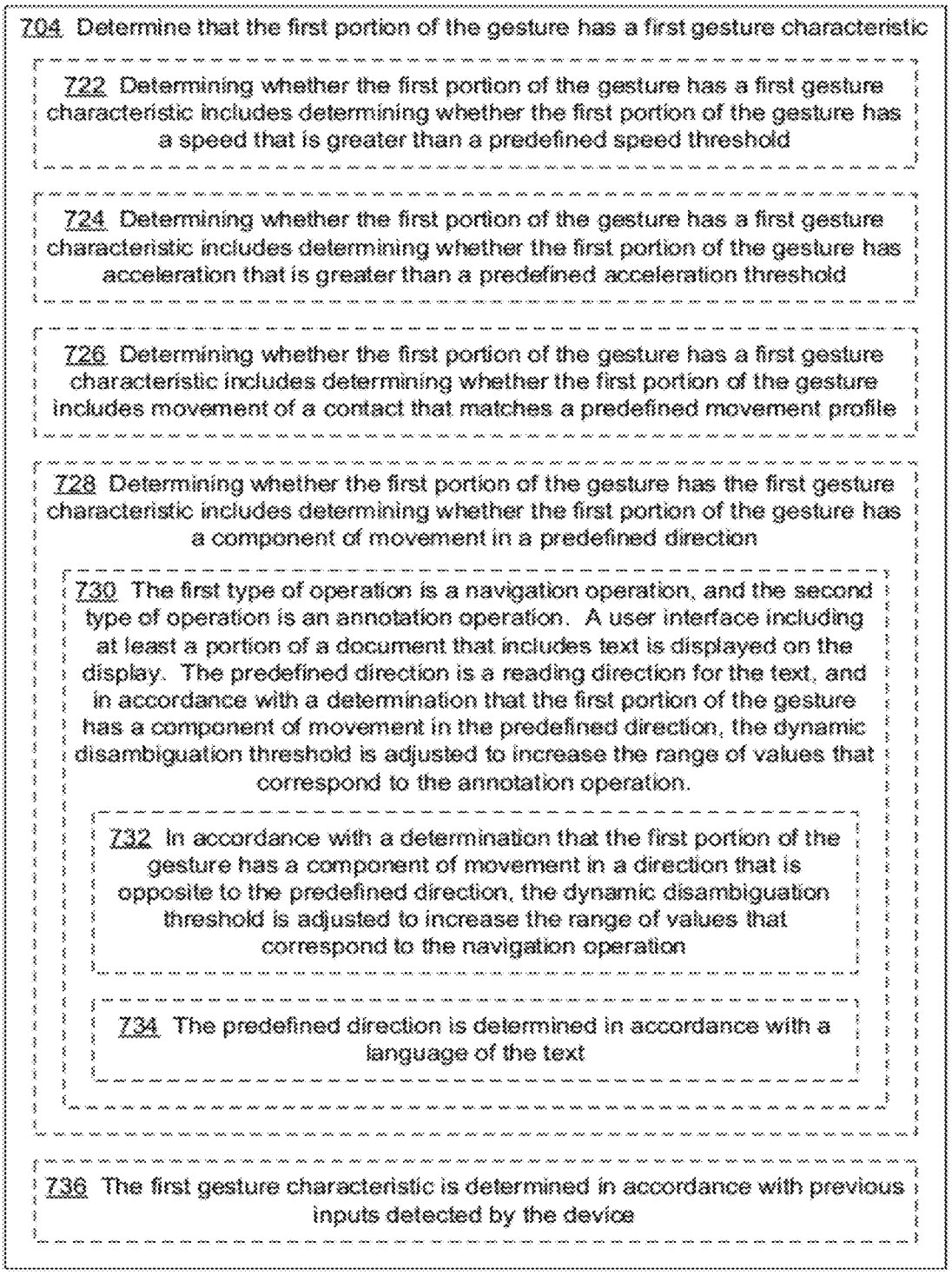

704 Determine that the first portion of the gesture has a first gesture characteristic
722 Determining whether the first portion of the gesture has a first gesture characteristic includes determining whether the first portion of the gesture has a speed that is greater than a predefined speed threshold
724 Determining whether the first portion of the gesture has a first gesture characteristic includes determining whether the first portion of the gesture has acceleration that is greater than a predefined acceleration threshold
726 Determining whether the first portion of the gesture has a first gesture characteristic includes determining whether the first portion of the gesture includes movement of a contact that matches a predefined movement profile
728 Determining whether the first portion of the gesture has the first gesture characteristic includes determining whether the first portion of the gesture has a component of movement in a predefined direction
730 The first type of operation is a navigation operation, and the second type of operation is an annotation operation. A user interface including at least a portion of a document that includes text is displayed on the display. The predefined direction is a reading direction for the text, and in accordance with a determination that the first portion of the gesture has a component of movement in the predefined direction, the dynamic disambiguation threshold is adjusted to increase the range of values that correspond to the annotation operation.
732 In accordance with a determination that the first portion of the gesture has a component of movement in a direction that is opposite to the predefined direction, the dynamic disambiguation threshold is adjusted to increase the range of values that correspond to the navigation operation
734 The predefined direction is determined in accordance with a language of the text
736 The first gesture characteristic is determined in accordance with previous inputs detected by the device

Figure 7C

756 The first type of operation is a navigation operation for an electronic document displayed on the display, and the second type of operation is an annotation operation for the electronic document. The first gesture characteristic is a navigation characteristic. In accordance with a determination that the gesture has the first gesture characteristic, the dynamic disambiguation threshold is adjusted to increase the range of values that correspond to the navigation operation.

758 A user interface that includes a current portion of the electronic document is displayed on the display, and the navigation operation includes displaying a different portion of the electronic document in the user interface in accordance with the gesture.

760 The first type of operation is a navigation operation for an electronic document displayed on the display, and the second type of operation is an annotation operation for the electronic document. The first gesture characteristic is an annotation characteristic. In accordance with a determination that the gesture has the first gesture characteristic, the dynamic disambiguation threshold is adjusted to increase the range of values that correspond to the annotation operation.

762 A user interface that includes at least a portion of the electronic document having predefined content is displayed on the display, and the annotation operation includes adding additional content to the predefined content.

Figure 7D

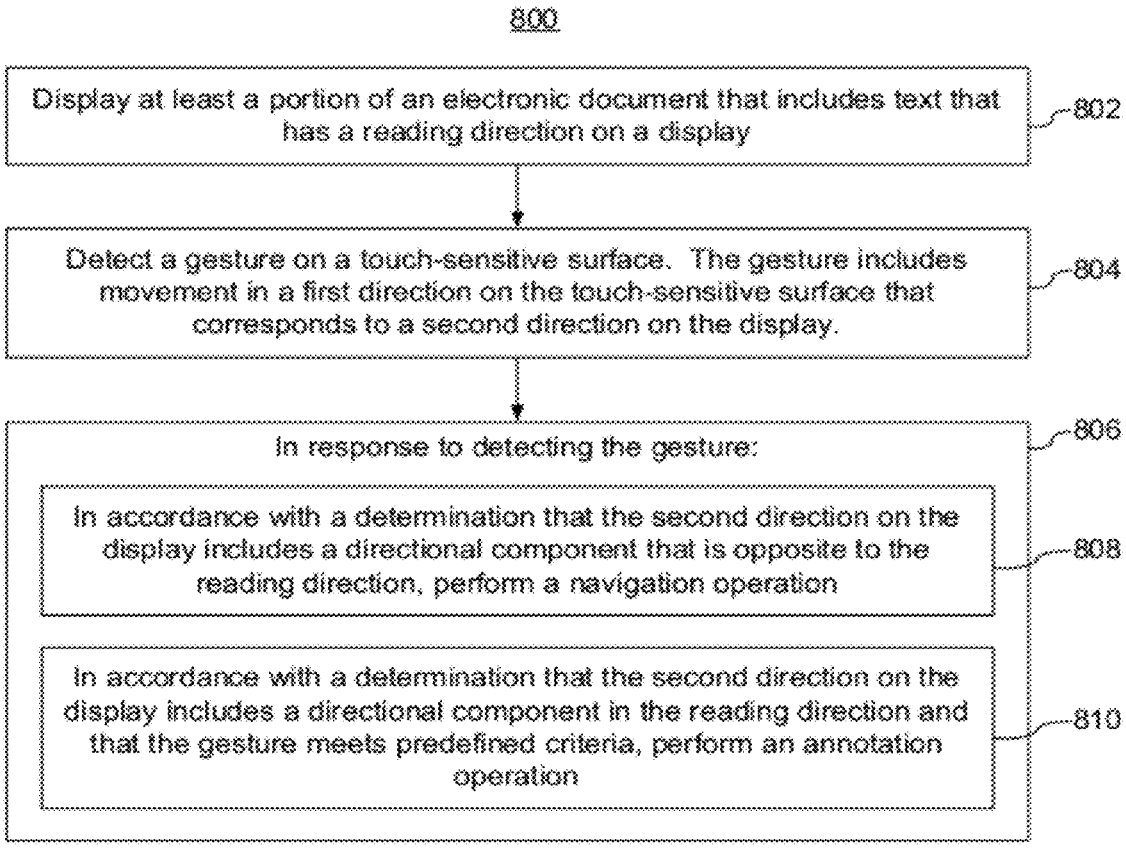

800
Display at least a portion of an electronic document that includes text that has a reading direction on a display
802
Detect a gesture on a touch-sensitive surface. The gesture includes movement in a first direction on the touch-sensitive surface that corresponds to a second direction on the display.
804
In response to detecting the gesture:
806
In accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, perform a navigation operation
808
In accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria, perform an annotation operation
810

Figure 8

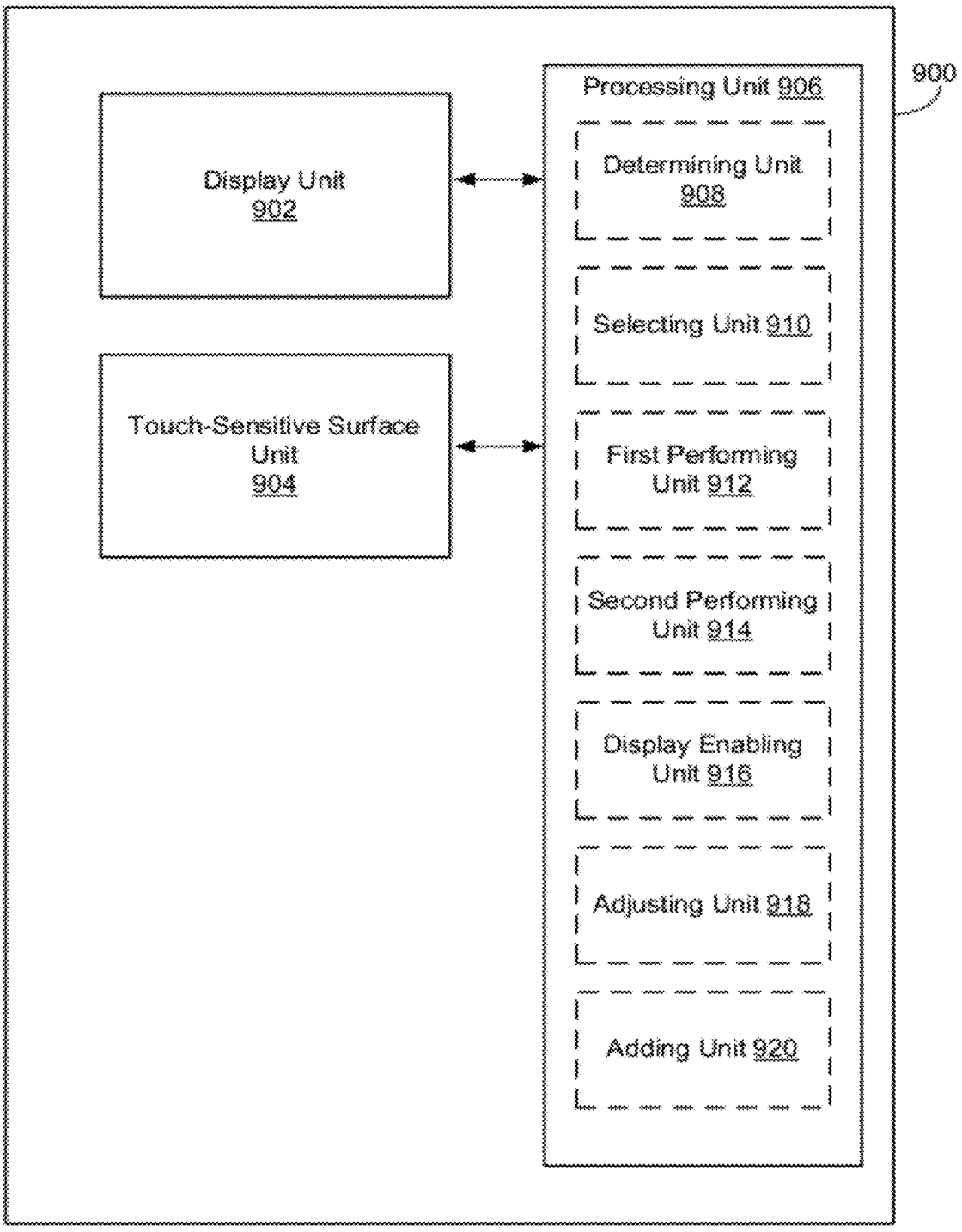

900
Processing Unit 906
Display Unit 902
Touch-Sensitive Surface Unit 904
Determining Unit 908
Selecting Unit 910
First Performing Unit 912
Second Performing Unit 914
Display Enabling Unit 916
Adjusting Unit 918
Adding Unit 920

Figure 9

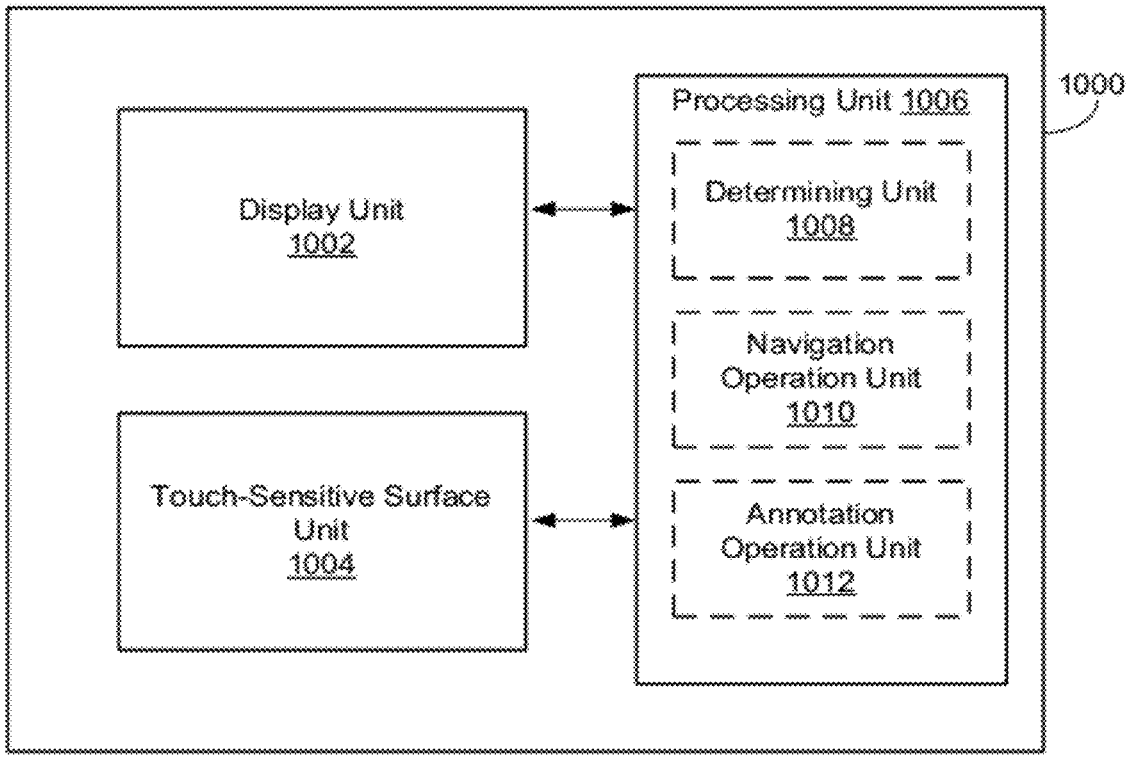

1000
Processing Unit 1006
Determining Unit 1008
Navigation Operation Unit 1010
Annotation Operation Unit 1012
Display Unit 1002
Touch-Sensitive Surface Unit 1004

Figure 10

DEVICE, METHOD, AND GRAPHICAL USER INTERFACE WITH A DYNAMIC GESTURE DISAMBIGUATION THRESHOLD

RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application Ser. No. 61/435,779, filed Jan. 24, 2011, entitled "Device, Method, and Graphical User Interface with a Dynamic Gesture Disambiguation Threshold," which is incorporated by reference herein in its entirety.

This application is related to U.S. application Ser. No. 13/077,711, filed Mar. 31, 2011, entitled "Device, Method, and Graphical User Interface with a Dynamic Gesture Disambiguation Threshold," which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

This relates generally to electronic devices with touch-sensitive surfaces, including but not limited to electronic devices that interpret and respond to user gestures on a touch-sensitive surface.

BACKGROUND

The use of touch-sensitive surfaces as input devices for computers and other electronic computing devices has increased significantly in recent years. Exemplary touch-sensitive surfaces include touch pads and touch screen displays. Such surfaces are widely used to manipulate user interface objects on a display.

For electronic devices with touch-sensitive surfaces, existing methods for interpreting user gestures are inefficient. In particular, electronic devices may not accurately interpret gesture inputs in accordance with a user's intent. For example, when displaying a page in an electronic document, such devices may turn to a next page in the electronic document in response to the user's gesture, when the user actually wanted to highlight a portion of the displayed page. Thus, the user has to go back to the correct page and then retry the gesture input to highlight the portion of the correct page. This is tedious and creates a significant cognitive burden on the user. In addition, such undo-and-retry actions waste time and energy. This latter consideration is particularly important in battery-operated devices.

SUMMARY

Accordingly, there is a need for electronic devices with more accurate and efficient methods and interfaces for interpreting user gestures on a touch-sensitive surface. Such methods and interfaces may complement or replace conventional methods for interpreting user gestures on a touch-sensitive surface. Such methods and interfaces reduce the cognitive burden on a user and produce a more efficient human-machine interface. For battery-operated devices, such methods and interfaces conserve power and increase the time between battery charges.

The above deficiencies and other problems associated with user interfaces for electronic devices with touch-sensitive surfaces are reduced or eliminated by the disclosed devices. In some embodiments, the device is a desktop computer. In some embodiments, the device is portable (e.g., a notebook computer, tablet computer, or handheld device). In some embodiments, the device has a touchpad. In some embodiments, the device has a touch-sensitive display (also known as a "touch screen" or "touch screen display"). In some embodiments, the device has a graphical user interface (GUI), one or more processors, memory and one or more modules, programs or sets of instructions stored in the memory for performing multiple functions. In some embodiments, the user interacts with the GUI primarily through finger contacts and gestures on the touch-sensitive surface. In some embodiments, the functions may include image editing, drawing, presenting, word processing, website creating, disk authoring, spreadsheet making, game playing, telephoning, video conferencing, e-mailing, instant messaging, workout support, digital photographing, digital videoing, web browsing, digital music playing, and/or digital video playing. Executable instructions for performing these functions may be included in a non-transitory computer readable storage medium or other computer program product configured for execution by one or more processors.

In accordance with some embodiments, a method is performed at an electronic device with a display and a touch-sensitive surface. The method includes: detecting a first portion of a gesture, and determining that the first portion of the gesture has a first gesture characteristic. The method also includes, in response to determining that the first portion of the gesture has a first gesture characteristic, selecting a dynamic disambiguation threshold in accordance with the first gesture characteristic. The dynamic disambiguation threshold is used to determine whether to perform a first type of operation or a second type of operation when a first kind of gesture is detected. The method includes determining that the gesture is a gesture of the first kind of gesture, and after selecting the dynamic disambiguation threshold, determining whether the gesture meets the dynamic disambiguation threshold. The method includes, in accordance with a determination that the gesture meets the dynamic disambiguation threshold, performing the first type of operation in accordance with the gesture, and in accordance with a determination that the gesture does not meet the dynamic disambiguation threshold, performing the second type of operation in accordance with the gesture.

In accordance with some embodiments, an electronic device includes a display, a touch-sensitive surface, one or more processors, memory, and one or more programs. The one or more programs are stored in the memory and configured to be executed by the one or more processors. The one or more programs include instructions for: detecting a first portion of a gesture, and determining that the first portion of the gesture has a first gesture characteristic. The one or more programs also include instructions for, in response to determining that the first portion of the gesture has a first gesture characteristic, selecting a dynamic disambiguation threshold in accordance with the first gesture characteristic. The dynamic disambiguation threshold is used to determine whether to perform a first type of operation or a second type of operation when a first kind of gesture is detected. The one or more programs include instructions for determining that the gesture is a gesture of the first kind of gesture, and after selecting the dynamic disambiguation threshold, determining whether the gesture meets the dynamic disambiguation threshold. The one or more programs furthermore include instructions for: in accordance with a determination that the gesture meets the dynamic disambiguation threshold, performing the first type of operation in accordance with the gesture; and in accordance with a determination that the gesture does not meet the dynamic disambiguation threshold, performing the second type of operation in accordance with the gesture.

In accordance with some embodiments, a graphical user interface on an electronic device with a display, a touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory includes at least a portion of an electronic document. A first portion of a gesture is detected, and the first portion of the gesture is determined to have a first gesture characteristic. In response to determining that the first portion of the gesture has the first gesture characteristic, a dynamic disambiguation threshold is selected in accordance with the first gesture characteristic. The dynamic disambiguation threshold is used to determine whether to perform a first type of operation or a second type of operation when a first kind of gesture is detected. The gesture is determined to be a gesture of the first kind of gesture. After selecting the dynamic disambiguation threshold, whether the gesture meets the dynamic disambiguation threshold is determined. In accordance with a determination that the gesture meets the dynamic disambiguation threshold, the first type of operation is performed in accordance with the gesture, and in accordance with a determination that the gesture does not meet the dynamic disambiguation threshold, the second type of operation is performed in accordance with the gesture.

In accordance with some embodiments, a computer readable storage medium has stored therein instructions which when executed by an electronic device with a display and a touch-sensitive surface, cause the device to: detect a first portion of a gesture, and determine that the first portion of the gesture has a first gesture characteristic. The instructions also cause the device to, in response to determining that the first portion of the gesture has a first gesture characteristic, select a dynamic disambiguation threshold in accordance with the first gesture characteristic. The dynamic disambiguation threshold is used to determine whether to perform a first type of operation or a second type of operation when a first kind of gesture is detected. The instructions cause the device to determine that the gesture is a gesture of the first kind of gesture, and after selecting the dynamic disambiguation threshold, determine whether the gesture meets the dynamic disambiguation threshold. The instructions furthermore cause the device to, in accordance with a determination that the gesture meets the dynamic disambiguation threshold, perform the first type of operation in accordance with the gesture, and in accordance with a determination that the gesture does not meet the dynamic disambiguation threshold, perform the second type of operation in accordance with the gesture.

In accordance with some embodiments, an electronic device includes: a display; a touch-sensitive surface; means for detecting a first portion of a gesture; and means for determining that the first portion of the gesture has a first gesture characteristic. The electronic device also includes means, enabled in response to determining that the first portion of the gesture has a first gesture characteristic, for selecting a dynamic disambiguation threshold in accordance with the first gesture characteristic. The dynamic disambiguation threshold is used to determine whether to perform a first type of operation or a second type of operation when a first kind of gesture is detected. The electronic device includes means for determining that the gesture is a gesture of the first kind of gesture; and means, enabled after selecting the dynamic disambiguation threshold, for determining whether the gesture meets the dynamic disambiguation threshold. The electronic device furthermore includes means, enabled in accordance with a determination that the gesture meets the dynamic disambiguation threshold, for performing the first type of operation in accordance with the gesture; and means, enabled in accordance with a determination that the gesture does not meet the dynamic disambiguation threshold, for performing the second type of operation in accordance with the gesture.

In accordance with some embodiments, an information processing apparatus for use in an electronic device with a display and a touch-sensitive surface includes: means for means for detecting a first portion of a gesture; and means for determining that the first portion of the gesture has a first gesture characteristic. The information processing apparatus also includes means, enabled in response to determining that the first portion of the gesture has a first gesture characteristic, for selecting a dynamic disambiguation threshold in accordance with the first gesture characteristic. The dynamic disambiguation threshold is used to determine whether to perform a first type of operation or a second type of operation when a first kind of gesture is detected. The information processing apparatus includes means for determining that the gesture is a gesture of the first kind of gesture; and means, enabled after selecting the dynamic disambiguation threshold, for determining whether the gesture meets the dynamic disambiguation threshold. The information processing apparatus furthermore includes means, enabled in accordance with a determination that the gesture meets the dynamic disambiguation threshold, for performing the first type of operation in accordance with the gesture; and means, enabled in accordance with a determination that the gesture does not meet the dynamic disambiguation threshold, for performing the second type of operation in accordance with the gesture.

In accordance with some embodiments, a method is performed at an electronic device with a display and a touch-sensitive surface. The method includes displaying at least a portion of an electronic document that includes text that has a reading direction, and detecting a gesture on the touch-sensitive surface. The gesture includes movement in a first direction on the touch-sensitive surface that corresponds to a second direction on the display. The method also includes, in response to detecting the gesture: in accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, performing a navigation operation, and in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria, performing an annotation operation.

In accordance with some embodiments, an electronic device includes a display, a touch-sensitive surface, one or more processors, memory, and one or more programs. The one or more programs are stored in the memory and configured to be executed by the one or more processors. The one or more programs include instructions for: displaying at least a portion of an electronic document that includes text that has a reading direction; and detecting a gesture on the touch-sensitive surface. The gesture includes movement in a first direction on the touch-sensitive surface that corresponds to a second direction on the display. The one or more programs also include instructions for, in response to detecting the gesture: in accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, performing a navigation operation, and in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria, performing an annotation operation.

In accordance with some embodiments, a graphical user interface on an electronic device with a display, a touch-sensitive surface, a memory, and one or more processors to execute one or more programs stored in the memory includes at least a portion of an electronic document that includes text

that has a reading direction. A gesture is detected on the touch-sensitive surface. The gesture includes movement in a first direction on the touch-sensitive surface that corresponds to a second direction on the display. In response to detecting the gesture, in accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, a navigation operation is performed, and in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria, an annotation operation is performed.

In accordance with some embodiments, a computer readable storage medium has stored therein instructions which when executed by an electronic device with a display and a touch-sensitive surface, cause the device to: display at least a portion of an electronic document that includes text that has a reading direction, and detect a gesture on the touch-sensitive surface. The gesture includes movement in a first direction on the touch-sensitive surface that corresponds to a second direction on the display. The instructions cause the device to, in response to detecting the gesture: in accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, perform a navigation operation; and in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria, perform an annotation operation.

In accordance with some embodiments, an electronic device includes: a display; a touch-sensitive surface; means for displaying at least a portion of an electronic document that includes text that has a reading direction; and means for detecting a gesture on the touch-sensitive surface. The gesture includes movement in a first direction on the touch-sensitive surface that corresponds to a second direction on the display. The electronic device includes means, enabled in response to detecting the gesture, including: means, enabled in accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, for performing a navigation operation; and means, enabled in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria, for performing an annotation operation.

In accordance with some embodiments, an information processing apparatus for use in an electronic device with a display and a touch-sensitive surface includes: means for displaying at least a portion of an electronic document that includes text that has a reading direction; and means for detecting a gesture on the touch-sensitive surface. The gesture includes movement in a first direction on the touch-sensitive surface that corresponds to a second direction on the display. The information processing apparatus includes means, enabled in response to detecting the gesture, including: means, enabled in accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, for performing a navigation operation; and means, enabled in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria, for performing an annotation operation.

In accordance with some embodiments, an electronic device includes a display unit; a touch-sensitive surface unit configured to detect a first portion of a gesture; and a processing unit coupled to the display unit and the touch-sensitive surface unit. The processing unit is configured to: determine that the first portion of the gesture has a first gesture characteristic; and in response to determining that the first portion of the gesture has a first gesture characteristic, select a dynamic disambiguation threshold in accordance with the first gesture characteristic. The dynamic disambiguation threshold is used to determine whether to perform a first type of operation or a second type of operation when a first kind of gesture is detected on the touch-sensitive surface unit. The processing unit is also configured to: determine that the gesture is a gesture of the first kind of gesture; after selecting the dynamic disambiguation threshold, determine whether the gesture meets the dynamic disambiguation threshold; in accordance with a determination that the gesture meets the dynamic disambiguation threshold, perform the first type of operation in accordance with the gesture; and in accordance with a determination that the gesture does not meet the dynamic disambiguation threshold, perform the second type of operation in accordance with the gesture.

In accordance with some embodiments, an electronic device includes a display unit configured to display at least a portion of an electronic document that includes text that has a reading direction on the display unit, and a touch-sensitive surface unit configured to detect a gesture. The gesture includes movement in a first direction on the touch-sensitive surface unit that corresponds to a second direction on the display unit. The electronic device **1000** also includes a processing unit coupled to the display unit and the touch-sensitive surface unit. The processing unit is configured to, in response to detecting the gesture: in accordance with a determination that the second direction on the display unit includes a directional component that is opposite to the reading direction, perform a navigation operation; and in accordance with a determination that the second direction on the display unit includes a directional component in the reading direction and that the gesture meets predefined criteria, perform an annotation operation.

Thus, electronic devices with displays and touch-sensitive surfaces are provided with faster, more efficient methods and interfaces for interpreting user gestures, thereby increasing the effectiveness, efficiency, and user satisfaction with such devices. Such methods and interfaces may complement or replace conventional methods for interpreting user gestures on a touch-sensitive surface.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the aforementioned embodiments of the invention as well as additional embodiments thereof, reference should be made to the Description of Embodiments below, in conjunction with the following drawings in which like reference numerals refer to corresponding parts throughout the figures.

FIG. **1**A is a block diagram illustrating a portable multifunction device with a touch-sensitive display in accordance with some embodiments.

FIG. **1**B is a block diagram illustrating exemplary components for event handling in accordance with some embodiments.

FIG. **2** illustrates a portable multifunction device having a touch screen in accordance with some embodiments.

FIG. **3** is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments.

FIG. **4**A illustrates an exemplary user interface for a menu of applications on a portable multifunction device in accordance with some embodiments.

FIG. **4**B illustrates an exemplary user interface for a multifunction device with a touch-sensitive surface that is separate from the display in accordance with some embodiments.

FIGS. **5**A-**5**C illustrate exemplary user interfaces for navigating and annotating an electronic document in accordance with some embodiments.

FIG. **6** illustrates exemplary functions representing movements of respective finger contacts in respective gestures in accordance with some embodiments.

FIGS. **7**A-**7**D are flow diagrams illustrating a method of using a dynamic disambiguation threshold to interpret a gesture in accordance with some embodiments.

FIG. **8** is a flow diagram illustrating a method of interpreting a gesture as a navigation operation or an annotation operation for an electronic document in accordance with some embodiments.

FIG. **9** is a functional block diagram of an electronic device in accordance with some embodiments.

FIG. **10** is a functional block diagram of an electronic device in accordance with some embodiments.

DESCRIPTION OF EMBODIMENTS

Many electronic devices receive gesture inputs on touch-sensitive surfaces. Such devices often have difficulty accurately and efficiently interpreting gesture inputs from users. With such devices, the users may need to undo and repeat gestures until desired operations are performed, which wastes energy and creates a cognitive burden for the users. The embodiments described below address this problem by providing a dynamic disambiguation threshold that is used to determine whether to perform a first type of operation (e.g., a navigation operation in an electronic document) or a second type of operation (e.g., an annotation operation in the electronic document). The dynamic disambiguation threshold (e.g., a speed threshold) is selected in accordance with an initial characteristic of the gesture (e.g., an initial location and/or speed of the gesture), as the initial characteristic of the gesture may indicate the user's intent. For example, an initial contact in the margin of an electronic document is more likely to be the start of a navigation gesture, so the speed threshold is lowered so that more finger movements will be interpreted as navigation gestures (e.g., page turning gestures) rather than as annotation gestures (e.g., highlighting gestures). Conversely, an initial contact in the text of an electronic document is more likely to be the start of an annotation gesture, so the speed threshold is raised so that more finger movements will be interpreted as annotation gestures rather than as navigation gestures. As another example, a high initial speed of a contact is more likely to be the start of a navigation gesture, so the speed threshold is lowered so that more finger movements will be interpreted as navigation gestures rather than as annotation gestures. Conversely, a nearly stationary initial contact is more likely to be the start of an annotation gesture, so the speed threshold is raised so that more finger movements will be interpreted as annotation gestures rather than as navigation gestures. When the gesture satisfies the dynamic disambiguation threshold (e.g., the gesture is faster than the dynamic speed threshold), the device performs the first type of operation (e.g., a navigation operation), and when the gesture does not satisfy the dynamic disambiguation threshold (e.g., the gesture is slower than the dynamic speed threshold), the device performs the second type of operation (e.g., an annotation operation). This method reduces misinterpretation of gesture inputs, thereby creating a more efficient human-machine interface.

Below, FIGS. **1**A-**1**B, **2**, **3**, **9**, and **10** provide a description of exemplary devices. FIGS. **4**A-**4**B and **5**A-**5**C illustrate exemplary user interfaces for navigating through, and annotating, an electronic document. FIG. **6** illustrates gesture characteristics based on exemplary movements of finger contacts. FIGS. **7**A-**7**D and FIG. **8** are flow diagrams illustrating methods of using a dynamic disambiguation threshold to interpret a gesture, and interpreting a gesture as a navigation operation or an annotation operation for an electronic document, respectively. The user interfaces in FIGS. **5**A-**5**C are used to illustrate the processes in FIGS. **7**A-**7**D and FIG. **8**.

Exemplary Devices

Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings. In the following detailed description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, components, circuits, and networks have not been described in detail so as not to unnecessarily obscure aspects of the embodiments.

It will also be understood that, although the terms first, second, etc. may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another. For example, a first contact could be termed a second contact, and, similarly, a second contact could be termed a first contact, without departing from the scope of the present invention. The first contact and the second contact are both contacts, but they are not the same contact.

The terminology used in the description of the invention herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used in the description of the invention and the appended claims, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will also be understood that the term "and/or" as used herein refers to and encompasses any and all possible combinations of one or more of the associated listed items. It will be further understood that the terms "includes," "including," "comprises," and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

As used herein, the term "if" may be construed to mean "when" or "upon" or "in response to determining" or "in response to detecting," depending on the context. Similarly, the phrase "if it is determined" or "if [a stated condition or event] is detected" may be construed to mean "upon determining" or "in response to determining" or "upon detecting [the stated condition or event]" or "in response to detecting [the stated condition or event]," depending on the context.

Embodiments of electronic devices, user interfaces for such devices, and associated processes for using such devices are described. In some embodiments, the device is a portable communications device, such as a mobile telephone, that also contains other functions, such as PDA and/or music player functions. Exemplary embodiments of portable multifunction devices include, without limitation, the iPhone®, iPod Touch®, and iPad® devices from Apple Inc. of Cupertino, Calif. Other portable electronic devices, such as laptops or tablet computers with touch-sensitive surfaces (e.g., touch

screen displays and/or touch pads), may also be used. It should also be understood that, in some embodiments, the device is not a portable communications device, but is a desktop computer with a touch-sensitive surface (e.g., a touch screen display and/or a touch pad).

In the discussion that follows, an electronic device that includes a display and a touch-sensitive surface is described. It should be understood, however, that the electronic device may include one or more other physical user-interface devices, such as a physical keyboard, a mouse and/or a joystick.

The device typically supports a variety of applications, such as one or more of the following: a drawing application, a presentation application, a word processing application, a website creation application, a disk authoring application, a spreadsheet application, a gaming application, a telephone application, a video conferencing application, an e-mail application, an instant messaging application, a workout support application, a photo management application, a digital camera application, a digital video camera application, a web browsing application, a digital music player application, and/or a digital video player application.

The various applications that may be executed on the device may use at least one common physical user-interface device, such as the touch-sensitive surface. One or more functions of the touch-sensitive surface as well as corresponding information displayed on the device may be adjusted and/or varied from one application to the next and/or within a respective application. In this way, a common physical architecture (such as the touch-sensitive surface) of the device may support the variety of applications with user interfaces that are intuitive and transparent to the user.

Attention is now directed toward embodiments of portable devices with touch-sensitive displays. FIG. **1A** is a block diagram illustrating portable multifunction device **100** with touch-sensitive displays **112** in accordance with some embodiments. Touch-sensitive display **112** is sometimes called a "touch screen" for convenience, and may also be known as or called a touch-sensitive display system. Device **100** may include memory **102** (which may include one or more computer readable storage mediums), memory controller **122**, one or more processing units (CPU's) **120**, peripherals interface **118**, RF circuitry **108**, audio circuitry **110**, speaker **111**, microphone **113**, input/output (I/O) subsystem **106**, other input or control devices **116**, and external port **124**. Device **100** may include one or more optical sensors **164**. These components may communicate over one or more communication buses or signal lines **103**.

It should be appreciated that device **100** is only one example of a portable multifunction device, and that device **100** may have more or fewer components than shown, may combine two or more components, or may have a different configuration or arrangement of the components. The various components shown in FIG. **1A** may be implemented in hardware, software, or a combination of both hardware and software, including one or more signal processing and/or application specific integrated circuits.

Memory **102** may include high-speed random access memory and may also include non-volatile memory, such as one or more magnetic disk storage devices, flash memory devices, or other non-volatile solid-state memory devices. Access to memory **102** by other components of device **100**, such as CPU **120** and the peripherals interface **118**, may be controlled by memory controller **122**.

Peripherals interface **118** can be used to couple input and output peripherals of the device to CPU **120** and memory **102**. The one or more processors **120** run or execute various software programs and/or sets of instructions stored in memory **102** to perform various functions for device **100** and to process data.

In some embodiments, peripherals interface **118**, CPU **120**, and memory controller **122** may be implemented on a single chip, such as chip **104**. In some other embodiments, they may be implemented on separate chips.

RF (radio frequency) circuitry **108** receives and sends RF signals, also called electromagnetic signals. RF circuitry **108** converts electrical signals to/from electromagnetic signals and communicates with communications networks and other communications devices via the electromagnetic signals. RF circuitry **108** may include well-known circuitry for performing these functions, including but not limited to an antenna system, an RF transceiver, one or more amplifiers, a tuner, one or more oscillators, a digital signal processor, a CODEC chipset, a subscriber identity module (SIM) card, memory, and so forth. RF circuitry **108** may communicate with networks, such as the Internet, also referred to as the World Wide Web (WWW), an intranet and/or a wireless network, such as a cellular telephone network, a wireless local area network (LAN) and/or a metropolitan area network (MAN), and other devices by wireless communication. The wireless communication may use any of a plurality of communications standards, protocols and technologies, including but not limited to Global System for Mobile Communications (GSM), Enhanced Data GSM Environment (EDGE), high-speed downlink packet access (HSDPA), high-speed uplink packet access (HSUPA), wideband code division multiple access (W-CDMA), code division multiple access (CDMA), time division multiple access (TDMA), Bluetooth, Wireless Fidelity (Wi-Fi) (e.g., IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n), voice over Internet Protocol (VoIP), Wi-MAX, a protocol for e-mail (e.g., Internet message access protocol (IMAP) and/or post office protocol (POP)), instant messaging (e.g., extensible messaging and presence protocol (XMPP), Session Initiation Protocol for Instant Messaging and Presence Leveraging Extensions (SIMPLE), Instant Messaging and Presence Service (IMPS)), and/or Short Message Service (SMS), or any other suitable communication protocol, including communication protocols not yet developed as of the filing date of this document.

Audio circuitry **110**, speaker **111**, and microphone **113** provide an audio interface between a user and device **100**. Audio circuitry **110** receives audio data from peripherals interface **118**, converts the audio data to an electrical signal, and transmits the electrical signal to speaker **111**. Speaker **111** converts the electrical signal to human-audible sound waves. Audio circuitry **110** also receives electrical signals converted by microphone **113** from sound waves. Audio circuitry **110** converts the electrical signal to audio data and transmits the audio data to peripherals interface **118** for processing. Audio data may be retrieved from and/or transmitted to memory **102** and/or RF circuitry **108** by peripherals interface **118**. In some embodiments, audio circuitry **110** also includes a headset jack (e.g., **212**, FIG. **2**). The headset jack provides an interface between audio circuitry **110** and removable audio input/output peripherals, such as output-only headphones or a headset with both output (e.g., a headphone for one or both ears) and input (e.g., a microphone).

I/O subsystem **106** couples input/output peripherals on device **100**, such as touch screen **112** and other input control devices **116**, to peripherals interface **118**. I/O subsystem **106** may include display controller **156** and one or more input controllers **160** for other input or control devices. The one or more input controllers **160** receive/send electrical signals from/to other input or control devices **116**. The other input

control devices **116** may include physical buttons (e.g., push buttons, rocker buttons, etc.), dials, slider switches, joysticks, click wheels, and so forth. In some alternate embodiments, input controller(s) **160** may be coupled to any (or none) of the following: a keyboard, infrared port, USB port, and a pointer device such as a mouse. The one or more buttons (e.g., **208**, FIG. **2**) may include an up/down button for volume control of speaker **111** and/or microphone **113**. The one or more buttons may include a push button (e.g., **206**, FIG. **2**).

Touch-sensitive display **112** provides an input interface and an output interface between the device and a user. Display controller **156** receives and/or sends electrical signals from/to touch screen **112**. Touch screen **112** displays visual output to the user. The visual output may include graphics, text, icons, video, and any combination thereof (collectively termed "graphics"). In some embodiments, some or all of the visual output may correspond to user-interface objects.

Touch screen **112** has a touch-sensitive surface, sensor or set of sensors that accepts input from the user based on haptic and/or tactile contact. Touch screen **112** and display controller **156** (along with any associated modules and/or sets of instructions in memory **102**) detect contact (and any movement or breaking of the contact) on touch screen **112** and converts the detected contact into interaction with user-interface objects (e.g., one or more soft keys, icons, web pages or images) that are displayed on touch screen **112**. In an exemplary embodiment, a point of contact between touch screen **112** and the user corresponds to a finger of the user.

Touch screen **112** may use LCD (liquid crystal display) technology, LPD (light emitting polymer display) technology, or LED (light emitting diode) technology, although other display technologies may be used in other embodiments. Touch screen **112** and display controller **156** may detect contact and any movement or breaking thereof using any of a plurality of touch sensing technologies now known or later developed, including but not limited to capacitive, resistive, infrared, and surface acoustic wave technologies, as well as other proximity sensor arrays or other elements for determining one or more points of contact with touch screen **112**. In an exemplary embodiment, projected mutual capacitance sensing technology is used, such as that found in the iPhone®, iPod Touch®, and iPad® from Apple Inc. of Cupertino, Calif.

Touch screen **112** may have a video resolution in excess of 100 dpi. In some embodiments, the touch screen has a video resolution of approximately 160 dpi. The user may make contact with touch screen **112** using any suitable object or appendage, such as a stylus, a finger, and so forth. In some embodiments, the user interface is designed to work primarily with finger-based contacts and gestures, which can be less precise than stylus-based input due to the larger area of contact of a finger on the touch screen. In some embodiments, the device translates the rough finger-based input into a precise pointer/cursor position or command for performing the actions desired by the user.

In some embodiments, in addition to the touch screen, device **100** may include a touchpad (not shown) for activating or deactivating particular functions. In some embodiments, the touchpad is a touch-sensitive area of the device that, unlike the touch screen, does not display visual output. The touchpad may be a touch-sensitive surface that is separate from touch screen **112** or an extension of the touch-sensitive surface formed by the touch screen.

Device **100** also includes power system **162** for powering the various components. Power system **162** may include a power management system, one or more power sources (e.g., battery, alternating current (AC)), a recharging system, a power failure detection circuit, a power converter or inverter, a power status indicator (e.g., a light-emitting diode (LED)) and any other components associated with the generation, management and distribution of power in portable devices.

Device **100** may also include one or more optical sensors **164**. FIG. **1**A shows an optical sensor coupled to optical sensor controller **158** in I/O subsystem **106**. Optical sensor **164** may include charge-coupled device (CCD) or complementary metal-oxide semiconductor (CMOS) phototransistors. Optical sensor **164** receives light from the environment, projected through one or more lens, and converts the light to data representing an image. In conjunction with imaging module **143** (also called a camera module), optical sensor **164** may capture still images or video. In some embodiments, an optical sensor is located on the back of device **100**, opposite touch screen display **112** on the front of the device, so that the touch screen display may be used as a viewfinder for still and/or video image acquisition. In some embodiments, another optical sensor is located on the front of the device so that the user's image may be obtained for videoconferencing while the user views the other video conference participants on the touch screen display.

Device **100** may also include one or more proximity sensors **166**. FIG. **1**A shows proximity sensor **166** coupled to peripherals interface **118**. Alternately, proximity sensor **166** may be coupled to input controller **160** in I/O subsystem **106**. In some embodiments, the proximity sensor turns off and disables touch screen **112** when the multifunction device is placed near the user's ear (e.g., when the user is making a phone call).

Device **100** may also include one or more accelerometers **168**. FIG. **1**A shows accelerometer **168** coupled to peripherals interface **118**. Alternately, accelerometer **168** may be coupled to an input controller **160** in I/O subsystem **106**. In some embodiments, information is displayed on the touch screen display in a portrait view or a landscape view based on an analysis of data received from the one or more accelerometers. Device **100** optionally includes, in addition to accelerometer(s) **168**, a magnetometer (not shown) and a GPS (or GLONASS or other global navigation system) receiver (not shown) for obtaining information concerning the location and orientation (e.g., portrait or landscape) of device **100**.

In some embodiments, the software components stored in memory **102** include operating system **126**, communication module (or set of instructions) **128**, contact/motion module (or set of instructions) **130**, graphics module (or set of instructions) **132**, text input module (or set of instructions) **134**, Global Positioning System (GPS) module (or set of instructions) **135**, and applications (or sets of instructions) **136**. Furthermore, in some embodiments memory **102** stores device/global internal state **157**, as shown in FIGS. **1**A and **3**. Device/global internal state **157** includes one or more of: active application state, indicating which applications, if any, are currently active; display state, indicating what applications, views or other information occupy various regions of touch screen display **112**; sensor state, including information obtained from the device's various sensors and input control devices **116**; and location information concerning the device's location and/or attitude.

Operating system **126** (e.g., Darwin, RTXC, LINUX, UNIX, OS X, WINDOWS, or an embedded operating system such as VxWorks) includes various software components and/or drivers for controlling and managing general system tasks (e.g., memory management, storage device control, power management, etc.) and facilitates communication between various hardware and software components.

Communication module **128** facilitates communication with other devices over one or more external ports **124** and

also includes various software components for handling data received by RF circuitry **108** and/or external port **124**. External port **124** (e.g., Universal Serial Bus (USB), FIREWIRE, etc.) is adapted for coupling directly to other devices or indirectly over a network (e.g., the Internet, wireless LAN, etc.). In some embodiments, the external port is a multi-pin (e.g., 30-pin) connector that is the same as, or similar to and/or compatible with the 30-pin connector used on iPod (trademark of Apple Inc.) devices.

Contact/motion module **130** may detect contact with touch screen **112** (in conjunction with display controller **156**) and other touch sensitive devices (e.g., a touchpad or physical click wheel). Contact/motion module **130** includes various software components for performing various operations related to detection of contact, such as determining if contact has occurred (e.g., detecting a finger-down event), determining if there is movement of the contact and tracking the movement across the touch-sensitive surface (e.g., detecting one or more finger-dragging events), and determining if the contact has ceased (e.g., detecting a finger-up event or a break in contact). Contact/motion module **130** receives contact data from the touch-sensitive surface. Determining movement of the point of contact, which is represented by a series of contact data, may include determining speed (magnitude), velocity (magnitude and direction), and/or an acceleration (a change in magnitude and/or direction) of the point of contact. These operations may be applied to single contacts (e.g., one finger contacts) or to multiple simultaneous contacts (e.g., "multitouch"/multiple finger contacts). In some embodiments, contact/motion module **130** and display controller **156** detect contact on a touchpad.

Contact/motion module **130** may detect a gesture input by a user. Different gestures on the touch-sensitive surface have different contact patterns. Thus, a gesture may be detected by detecting a particular contact pattern. For example, detecting a finger tap gesture includes detecting a finger-down event followed by detecting a finger-up (lift off) event at the same position (or substantially the same position) as the finger-down event (e.g., at the position of an icon). As another example, detecting a finger swipe gesture on the touch-sensitive surface includes detecting a finger-down event followed by detecting one or more finger-dragging events, and subsequently followed by detecting a finger-up (lift off) event.

Graphics module **132** includes various known software components for rendering and displaying graphics on touch screen **112** or other display, including components for changing the intensity of graphics that are displayed. As used herein, the term "graphics" includes any object that can be displayed to a user, including without limitation text, web pages, icons (such as user-interface objects including soft keys), digital images, videos, animations and the like.

In some embodiments, graphics module **132** stores data representing graphics to be used. Each graphic may be assigned a corresponding code. Graphics module **132** receives, from applications etc., one or more codes specifying graphics to be displayed along with, if necessary, coordinate data and other graphic property data, and then generates screen image data to output to display controller **156**.

Text input module **134**, which may be a component of graphics module **132**, provides soft keyboards for entering text in various applications (e.g., contacts **137**, e-mail **140**, IM **141**, browser **147**, and any other application that needs text input).

GPS module **135** determines the location of the device and provides this information for use in various applications (e.g., to telephone **138** for use in location-based dialing, to camera **143** as picture/video metadata, and to applications that provide location-based services such as weather widgets, local yellow page widgets, and map/navigation widgets).

Applications **136** may include the following modules (or sets of instructions), or a subset or superset thereof:

- contacts module **137** (sometimes called an address book or contact list);
- telephone module **138**;
- video conferencing module **139**;
- e-mail client module **140**;
- instant messaging (IM) module **141**;
- books module **142**;
- camera module **143** for still and/or video images;
- image management module **144**;
- browser module **147**;
- calendar module **148**;
- widget modules **149**, which may include one or more of: weather widget **149-1**, stocks widget **149-2**, calculator widget **149-3**, alarm clock widget **149-4**, dictionary widget **149-5**, and other widgets obtained by the user, as well as user-created widgets **149-6**;
- widget creator module **150** for making user-created widgets **149-6**;
- search module **151**;
- video and music player module **152**, which may be made up of a video player module and a music player module;
- notes module **153**;
- map module **154**; and/or
- online video module **155**.

Examples of other applications **136** that may be stored in memory **102** include other word processing applications, other image editing applications, drawing applications, presentation applications, JAVA-enabled applications, encryption, digital rights management, voice recognition, and voice replication.

In conjunction with touch screen **112**, display controller **156**, contact module **130**, graphics module **132**, and text input module **134**, contacts module **137** may be used to manage an address book or contact list (e.g., stored in application internal state **192** of contacts module **137** in memory **102** or memory **370**), including: adding name(s) to the address book; deleting name(s) from the address book; associating telephone number(s), e-mail address(es), physical address(es) or other information with a name; associating an image with a name; categorizing and sorting names; providing telephone numbers or e-mail addresses to initiate and/or facilitate communications by telephone **138**, video conference **139**, e-mail **140**, or IM **141**; and so forth.

In conjunction with RF circuitry **108**, audio circuitry **110**, speaker **111**, microphone **113**, touch screen **112**, display controller **156**, contact module **130**, graphics module **132**, and text input module **134**, telephone module **138** may be used to enter a sequence of characters corresponding to a telephone number, access one or more telephone numbers in address book **137**, modify a telephone number that has been entered, dial a respective telephone number, conduct a conversation and disconnect or hang up when the conversation is completed. As noted above, the wireless communication may use any of a plurality of communications standards, protocols and technologies.

In conjunction with RF circuitry **108**, audio circuitry **110**, speaker **111**, microphone **113**, touch screen **112**, display controller **156**, optical sensor **164**, optical sensor controller **158**, contact module **130**, graphics module **132**, text input module **134**, contact list **137**, and telephone module **138**, videoconferencing module **139** includes executable instructions to ini-

tiate, conduct, and terminate a video conference between a user and one or more other participants in accordance with user instructions.

In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact module **130**, graphics module **132**, and text input module **134**, e-mail client module **140** includes executable instructions to create, send, receive, and manage e-mail in response to user instructions. In conjunction with image management module **144**, e-mail client module **140** makes it very easy to create and send e-mails with still or video images taken with camera module **143**.

In conjunction with RF circuitry **108**, touch screen **112**, display controller **156**, contact module **130**, graphics module **132**, and text input module **134**, the instant messaging module **141** includes executable instructions to enter a sequence of characters corresponding to an instant message, to modify previously entered characters, to transmit a respective instant message (for example, using a Short Message Service (SMS) or Multimedia Message Service (MMS) protocol for telephony-based instant messages or using XMPP, SIMPLE, or IMPS for Internet-based instant messages), to receive instant messages and to view received instant messages. In some embodiments, transmitted and/or received instant messages may include graphics, photos, audio files, video files and/or other attachments as are supported in a MMS and/or an Enhanced Messaging Service (EMS). As used herein, "instant messaging" refers to both telephony-based messages (e.g., messages sent using SMS or MMS) and Internet-based messages (e.g., messages sent using XMPP, SIMPLE, or IMPS).

In conjunction with RF circuitry **108**, audio circuitry **110**, speaker **111**, microphone **113**, touch screen **112**, display controller **156**, optical sensor **164**, optical sensor controller **158**, contact module **130**, graphics module **132**, text input module **134**, contact list **137**, and telephone module **138**, books module **142** includes executable instructions to display, annotate, and share an electronic book (e.g., a text book), magazine, newspaper or other digital publication between a user and one or more other participants in accordance with user instructions.

In conjunction with touch screen **112**, display controller **156**, optical sensor(s) **164**, optical sensor controller **158**, contact module **130**, graphics module **132**, and image management module **144**, camera module **143** includes executable instructions to capture still images or video (including a video stream) and store them into memory **102**, modify characteristics of a still image or video, or delete a still image or video from memory **102**.

In conjunction with touch screen **112**, display controller **156**, contact module **130**, graphics module **132**, text input module **134**, and camera module **143**, image management module **144** includes executable instructions to arrange, modify (e.g., edit), or otherwise manipulate, label, delete, present (e.g., in a digital slide show or album), and store still and/or video images.

In conjunction with RF circuitry **108**, touch screen **112**, display system controller **156**, contact module **130**, graphics module **132**, and text input module **134**, browser module **147** includes executable instructions to browse the Internet in accordance with user instructions, including searching, linking to, receiving, and displaying web pages or portions thereof, as well as attachments and other files linked to web pages.

In conjunction with RF circuitry **108**, touch screen **112**, display system controller **156**, contact module **130**, graphics module **132**, text input module **134**, e-mail client module **140**, and browser module **147**, calendar module **148** includes executable instructions to create, display, modify, and store calendars and data associated with calendars (e.g., calendar entries, to do lists, etc.) in accordance with user instructions.

In conjunction with RF circuitry **108**, touch screen **112**, display system controller **156**, contact module **130**, graphics module **132**, text input module **134**, and browser module **147**, widget modules **149** are mini-applications that may be downloaded and used by a user (e.g., weather widget **149-1**, stocks widget **149-2**, calculator widget **149-3**, alarm clock widget **149-4**, and dictionary widget **149-5**) or created by the user (e.g., user-created widget **149-6**). In some embodiments, a widget includes an HTML (Hypertext Markup Language) file, a CSS (Cascading Style Sheets) file, and a JavaScript file. In some embodiments, a widget includes an XML (Extensible Markup Language) file and a JavaScript file (e.g., Yahoo! Widgets).

In conjunction with RF circuitry **108**, touch screen **112**, display system controller **156**, contact module **130**, graphics module **132**, text input module **134**, and browser module **147**, the widget creator module **150** may be used by a user to create widgets (e.g., turning a user-specified portion of a web page into a widget).

In conjunction with touch screen **112**, display system controller **156**, contact module **130**, graphics module **132**, and text input module **134**, search module **151** includes executable instructions to search for text, music, sound, image, video, and/or other files in memory **102** that match one or more search criteria (e.g., one or more user-specified search terms) in accordance with user instructions.

In conjunction with touch screen **112**, display system controller **156**, contact module **130**, graphics module **132**, audio circuitry **110**, speaker **111**, RF circuitry **108**, and browser module **147**, video and music player module **152** includes executable instructions that allow the user to download and play back recorded music and other sound files stored in one or more file formats, such as MP3 or AAC files, and executable instructions to display, present or otherwise play back videos (e.g., on touch screen **112** or on an external, connected display via external port **124**). In some embodiments, device **100** may include the functionality of an MP3 player, such as an iPod (trademark of Apple Inc.).

In conjunction with touch screen **112**, display controller **156**, contact module **130**, graphics module **132**, and text input module **134**, notes module **153** includes executable instructions to create and manage notes, to do lists, and the like in accordance with user instructions.

In conjunction with RF circuitry **108**, touch screen **112**, display system controller **156**, contact module **130**, graphics module **132**, text input module **134**, GPS module **135**, and browser module **147**, map module **154** may be used to receive, display, modify, and store maps and data associated with maps (e.g., driving directions; data on stores and other points of interest at or near a particular location; and other location-based data) in accordance with user instructions.

In conjunction with touch screen **112**, display system controller **156**, contact module **130**, graphics module **132**, audio circuitry **110**, speaker **111**, RF circuitry **108**, text input module **134**, e-mail client module **140**, and browser module **147**, online video module **155** includes instructions that allow the user to access, browse, receive (e.g., by streaming and/or download), play back (e.g., on the touch screen or on an external, connected display via external port **124**), send an e-mail with a link to a particular online video, and otherwise manage online videos in one or more file formats, such as H.264. In some embodiments, instant messaging module **141**, rather than e-mail client module **140**, is used to send a link to a particular online video.

Each of the above identified modules and applications correspond to a set of executable instructions for performing one or more functions described above and the methods described in this application (e.g., the computer-implemented methods and other information processing methods described herein). These modules (i.e., sets of instructions) need not be implemented as separate software programs, procedures or modules, and thus various subsets of these modules may be combined or otherwise re-arranged in various embodiments. In some embodiments, memory **102** may store a subset of the modules and data structures identified above. Furthermore, memory **102** may store additional modules and data structures not described above.

In some embodiments, device **100** is a device where operation of a predefined set of functions on the device is performed exclusively through a touch screen and/or a touchpad. By using a touch screen and/or a touchpad as the primary input control device for operation of device **100**, the number of physical input control devices (such as push buttons, dials, and the like) on device **100** may be reduced.

The predefined set of functions that may be performed exclusively through a touch screen and/or a touchpad include navigation between user interfaces. In some embodiments, the touchpad, when touched by the user, navigates device **100** to a main, home, or root menu from any user interface that may be displayed on device **100**. In such embodiments, the touchpad may be referred to as a "menu button." In some other embodiments, the menu button may be a physical push button or other physical input control device instead of a touchpad.

FIG. **1**C is a block diagram illustrating exemplary components for event handling in accordance with some embodiments. In some embodiments, memory **102** (in FIGS. **1**A and **1**B) or **370** (FIG. **3**) includes event sorter **170** (e.g., in operating system **126**) and a respective application **136-1** (e.g., any of the aforementioned applications **137-151**, **155**, **380-390**).

Event sorter **170** receives event information and determines the application **136-1** and application view **191** of application **136-1** to which to deliver the event information. Event sorter **170** includes event monitor **171** and event dispatcher module **174**. In some embodiments, application **136-1** includes application internal state **192**, which indicates the current application view(s) displayed on touch sensitive display **112** when the application is active or executing. In some embodiments, device/global internal state **157** is used by event sorter **170** to determine which application(s) is (are) currently active, and application internal state **192** is used by event sorter **170** to determine application views **191** to which to deliver event information.

In some embodiments, application internal state **192** includes additional information, such as one or more of: resume information to be used when application **136-1** resumes execution, user interface state information that indicates information being displayed or that is ready for display by application **136-1**, a state queue for enabling the user to go back to a prior state or view of application **136-1**, and a redo/undo queue of previous actions taken by the user.

Event monitor **171** receives event information from peripherals interface **118**. Event information includes information about a sub-event (e.g., a user touch on touch-sensitive display **112**, as part of a multi-touch gesture). Peripherals interface **118** transmits information it receives from I/O subsystem **106** or a sensor, such as proximity sensor **166**, accelerometer(s) **168**, and/or microphone **113** (through audio circuitry **110**). Information that peripherals interface **118** receives from I/O subsystem **106** includes information from touch-sensitive display **112** or a touch-sensitive surface.

In some embodiments, event monitor **171** sends requests to the peripherals interface **118** at predetermined intervals. In response, peripherals interface **118** transmits event information. In other embodiments, peripheral interface **118** transmits event information only when there is a significant event (e.g., receiving an input above a predetermined noise threshold and/or for more than a predetermined duration).

In some embodiments, event sorter **170** also includes a hit view determination module **172** and/or an active event recognizer determination module **173**.

Hit view determination module **172** provides software procedures for determining where a sub-event has taken place within one or more views, when touch sensitive display **112** displays more than one view. Views are made up of controls and other elements that a user can see on the display.

Another aspect of the user interface associated with an application is a set of views, sometimes herein called application views or user interface windows, in which information is displayed and touch-based gestures occur. The application views (of a respective application) in which a touch is detected may correspond to programmatic levels within a programmatic or view hierarchy of the application. For example, the lowest level view in which a touch is detected may be called the hit view, and the set of events that are recognized as proper inputs may be determined based, at least in part, on the hit view of the initial touch that begins a touch-based gesture.

Hit view determination module **172** receives information related to sub-events of a touch-based gesture. When an application has multiple views organized in a hierarchy, hit view determination module **172** identifies a hit view as the lowest view in the hierarchy which should handle the sub-event. In most circumstances, the hit view is the lowest level view in which an initiating sub-event occurs (i.e., the first sub-event in the sequence of sub-events that form an event or potential event). Once the hit view is identified by the hit view determination module, the hit view typically receives all sub-events related to the same touch or input source for which it was identified as the hit view.

Active event recognizer determination module **173** determines which view or views within a view hierarchy should receive a particular sequence of sub-events. In some embodiments, active event recognizer determination module **173** determines that only the hit view should receive a particular sequence of sub-events. In other embodiments, active event recognizer determination module **173** determines that all views that include the physical location of a sub-event are actively involved views, and therefore determines that all actively involved views should receive a particular sequence of sub-events. In other embodiments, even if touch sub-events were entirely confined to the area associated with one particular view, views higher in the hierarchy would still remain as actively involved views.

Event dispatcher module **174** dispatches the event information to an event recognizer (e.g., event recognizer **180**). In embodiments including active event recognizer determination module **173**, event dispatcher module **174** delivers the event information to an event recognizer determined by active event recognizer determination module **173**. In some embodiments, event dispatcher module **174** stores in an event queue the event information, which is retrieved by a respective event receiver module **182**.

In some embodiments, operating system **126** includes event sorter **170**. Alternatively, application **136-1** includes event sorter **170**. In yet other embodiments, event sorter **170**

is a stand-alone module, or a part of another module stored in memory **102**, such as contact/motion module **130**.

In some embodiments, application **136-1** includes a plurality of event handlers **190** and one or more application views **191**, each of which includes instructions for handling touch events that occur within a respective view of the application's user interface. Each application view **191** of the application **136-1** includes one or more event recognizers **180**. Typically, a respective application view **191** includes a plurality of event recognizers **180**. In other embodiments, one or more of event recognizers **180** are part of a separate module, such as a user interface kit (not shown) or a higher level object from which application **136-1** inherits methods and other properties. In some embodiments, a respective event handler **190** includes one or more of: data updater **176**, object updater **177**, GUI updater **178**, and/or event data **179** received from event sorter **170**. Event handler **190** may utilize or call data updater **176**, object updater **177** or GUI updater **178** to update the application internal state **192**. Alternatively, one or more of the application views **191** includes one or more respective event handlers **190**. Also, in some embodiments, one or more of data updater **176**, object updater **177**, and GUI updater **178** are included in a respective application view **191**.

A respective event recognizer **180** receives event information (e.g., event data **179**) from event sorter **170**, and identifies an event from the event information. Event recognizer **180** includes event receiver **182** and event comparator **184**. In some embodiments, event recognizer **180** also includes at least a subset of: metadata **183**, and event delivery instructions **188** (which may include sub-event delivery instructions).

Event receiver **182** receives event information from event sorter **170**. The event information includes information about a sub-event, for example, a touch or a touch movement. Depending on the sub-event, the event information also includes additional information, such as location of the sub-event. When the sub-event concerns motion of a touch the event information may also include speed and direction of the sub-event. In some embodiments, events include rotation of the device from one orientation to another (e.g., from a portrait orientation to a landscape orientation, or vice versa), and the event information includes corresponding information about the current orientation (also called device attitude) of the device.

Event comparator **184** compares the event information to predefined event or sub-event definitions and, based on the comparison, determines an event or sub-event, or determines or updates the state of an event or sub-event. In some embodiments, event comparator **184** includes event definitions **186**. Event definitions **186** contain definitions of events (e.g., predefined sequences of sub-events), for example, event **1** (**187-1**), event **2** (**187-2**), and others. In some embodiments, sub-events in an event **187** include, for example, touch begin, touch end, touch movement, touch cancellation, and multiple touching. In one example, the definition for event **1** (**187-1**) is a double tap on a displayed object. The double tap, for example, comprises a first touch (touch begin) on the displayed object for a predetermined phase, a first lift-off (touch end) for a predetermined phase, a second touch (touch begin) on the displayed object for a predetermined phase, and a second lift-off (touch end) for a predetermined phase. In another example, the definition for event **2** (**187-2**) is a dragging on a displayed object. The dragging, for example, comprises a touch (or contact) on the displayed object for a predetermined phase, a movement of the touch across touch-sensitive display **112**, and lift-off of the touch (touch end). In some embodiments, the event also includes information for one or more associated event handlers **190**.

In some embodiments, event definition **187** includes a definition of an event for a respective user-interface object. In some embodiments, event comparator **184** performs a hit test to determine which user-interface object is associated with a sub-event. For example, in an application view in which three user-interface objects are displayed on touch-sensitive display **112**, when a touch is detected on touch-sensitive display **112**, event comparator **184** performs a hit test to determine which of the three user-interface objects is associated with the touch (sub-event). If each displayed object is associated with a respective event handler **190**, the event comparator uses the result of the hit test to determine which event handler **190** should be activated. For example, event comparator **184** selects an event handler associated with the sub-event and the object triggering the hit test.

In some embodiments, the definition for a respective event **187** also includes delayed actions that delay delivery of the event information until after it has been determined whether the sequence of sub-events does or does not correspond to the event recognizer's event type.

When a respective event recognizer **180** determines that the series of sub-events do not match any of the events in event definitions **186**, the respective event recognizer **180** enters an event impossible, event failed, or event ended state, after which it disregards subsequent sub-events of the touch-based gesture. In this situation, other event recognizers, if any, that remain active for the hit view continue to track and process sub-events of an ongoing touch-based gesture.

In some embodiments, a respective event recognizer **180** includes metadata **183** with configurable properties, flags, and/or lists that indicate how the event delivery system should perform sub-event delivery to actively involved event recognizers. In some embodiments, metadata **183** includes configurable properties, flags, and/or lists that indicate how event recognizers may interact with one another. In some embodiments, metadata **183** includes configurable properties, flags, and/or lists that indicate whether sub-events are delivered to varying levels in the view or programmatic hierarchy.

In some embodiments, a respective event recognizer **180** activates event handler **190** associated with an event when one or more particular sub-events of an event are recognized. In some embodiments, a respective event recognizer **180** delivers event information associated with the event to event handler **190**. Activating an event handler **190** is distinct from sending (and deferred sending) sub-events to a respective hit view. In some embodiments, event recognizer **180** throws a flag associated with the recognized event, and event handler **190** associated with the flag catches the flag and performs a predefined process.

In some embodiments, event delivery instructions **188** include sub-event delivery instructions that deliver event information about a sub-event without activating an event handler. Instead, the sub-event delivery instructions deliver event information to event handlers associated with the series of sub-events or to actively involved views. Event handlers associated with the series of sub-events or with actively involved views receive the event information and perform a predetermined process.

In some embodiments, data updater **176** creates and updates data used in application **136-1**. For example, data updater **176** updates the telephone number used in contacts module **137**, or stores a video file used in video player module **145**. In some embodiments, object updater **177** creates and updates objects used in application **136-1**. For example, object updater **176** creates a new user-interface object or

updates the position of a user-interface object. GUI updater **178** updates the GUI. For example, GUI updater **178** prepares display information and sends it to graphics module **132** for display on a touch-sensitive display.

In some embodiments, event handler(s) **190** includes or has access to data updater **176**, object updater **177**, and GUI updater **178**. In some embodiments, data updater **176**, object updater **177**, and GUI updater **178** are included in a single module of a respective application **136-1** or application view **191**. In other embodiments, they are included in two or more software modules.

It shall be understood that the foregoing discussion regarding event handling of user touches on touch-sensitive displays also applies to other forms of user inputs to operate multifunction devices **100** with input-devices, not all of which are initiated on touch screens, e.g., coordinating mouse movement and mouse button presses with or without single or multiple keyboard presses or holds, user movements taps, drags, scrolls, etc., on touch-pads, pen stylus inputs, movement of the device, oral instructions, detected eye movements, biometric inputs, and/or any combination thereof, which may be utilized as inputs corresponding to sub-events which define an event to be recognized.

FIG. **2** illustrates a portable multifunction device **100** having a touch screen **112** in accordance with some embodiments. The touch screen may display one or more graphics within user interface (UI) **200**. In this embodiment, as well as others described below, a user may select one or more of the graphics by making a gesture on the graphics, for example, with one or more fingers **202** (not drawn to scale in the figure) or one or more styluses **203** (not drawn to scale in the figure). In some embodiments, selection of one or more graphics occurs when the user breaks contact with the one or more graphics. In some embodiments, the gesture may include one or more taps, one or more swipes (from left to right, right to left, upward and/or downward) and/or a rolling of a finger (from right to left, left to right, upward and/or downward) that has made contact with device **100**. In some embodiments, inadvertent contact with a graphic may not select the graphic. For example, a swipe gesture that sweeps over an application icon may not select the corresponding application when the gesture corresponding to selection is a tap.

Device **100** may also include one or more physical buttons, such as "home" or menu button **204**. As described previously, menu button **204** may be used to navigate to any application **136** in a set of applications that may be executed on device **100**. Alternatively, in some embodiments, the menu button is implemented as a soft key in a GUI displayed on touch screen **112**.

In one embodiment, device **100** includes touch screen **112**, menu button **204**, push button **206** for powering the device on/off and locking the device, volume adjustment button(s) **208**, Subscriber Identity Module (SIM) card slot **210**, head set jack **212**, and docking/charging external port **124**. Push button **206** may be used to turn the power on/off on the device by depressing the button and holding the button in the depressed state for a predefined time interval; to lock the device by depressing the button and releasing the button before the predefined time interval has elapsed; and/or to unlock the device or initiate an unlock process. In an alternative embodiment, device **100** also may accept verbal input for activation or deactivation of some functions through microphone **113**.

FIG. **3** is a block diagram of an exemplary multifunction device with a display and a touch-sensitive surface in accordance with some embodiments. Device **300** need not be portable. In some embodiments, device **300** is a laptop computer, a desktop computer, a tablet computer, a multimedia player device, a navigation device, an educational device (such as a child's learning toy), a gaming system, or a control device (e.g., a home or industrial controller). Device **300** typically includes one or more processing units (CPU's) **310**, one or more network or other communications interfaces **360**, memory **370**, and one or more communication buses **320** for interconnecting these components. Communication buses **320** may include circuitry (sometimes called a chipset) that interconnects and controls communications between system components. Device **300** includes input/output (I/O) interface **330** comprising display **340**, which is typically a touch screen display. I/O interface **330** also may include a keyboard and/or mouse (or other pointing device) **350** and touchpad **355**. Memory **370** includes high-speed random access memory, such as DRAM, SRAM, DDR RAM or other random access solid state memory devices; and may include non-volatile memory, such as one or more magnetic disk storage devices, optical disk storage devices, flash memory devices, or other non-volatile solid state storage devices. Memory **370** may optionally include one or more storage devices remotely located from CPU(s) **310**. In some embodiments, memory **370** stores programs, modules, and data structures analogous to the programs, modules, and data structures stored in memory **102** of portable multifunction device **100** (FIG. **1**), or a subset thereof. Furthermore, memory **370** may store additional programs, modules, and data structures not present in memory **102** of portable multifunction device **100**. For example, memory **370** of device **300** may store drawing module **380**, presentation module **382**, word processing module **384**, website creation module **386**, disk authoring module **388**, and/or spreadsheet module **390**, while memory **102** of portable multifunction device **100** (FIG. **1**) may not store these modules.

Each of the above identified elements in FIG. **3** may be stored in one or more of the previously mentioned memory devices. Each of the above identified modules corresponds to a set of instructions for performing a function described above. The above identified modules or programs (i.e., sets of instructions) need not be implemented as separate software programs, procedures or modules, and thus various subsets of these modules may be combined or otherwise re-arranged in various embodiments. In some embodiments, memory **370** may store a subset of the modules and data structures identified above. Furthermore, memory **370** may store additional modules and data structures not described above.

Attention is now directed towards embodiments of user interfaces ("UI") that may be implemented on portable multifunction device **100**.

FIG. **4A** illustrates an exemplary user interface for a menu of applications on portable multifunction device **100** in accordance with some embodiments. Similar user interfaces may be implemented on device **300**. In some embodiments, user interface **400** includes the following elements, or a subset or superset thereof:

- Signal strength indicator(s) **402** for wireless communication(s), such as cellular and Wi-Fi signals;
- Time **404**;
- Bluetooth indicator **405**;
- Battery status indicator **406**;
- Tray **408** with icons for frequently used applications, such as:
  - Phone **138**, which may include an indicator **414** of the number of missed calls or voicemail messages;
  - E-mail client **140**, which may include an indicator **410** of the number of unread e-mails;
  - Browser **147**; and

Video and music player **152**, also referred to as iPod (trademark of Apple Inc.) module **152**; and

Icons for other applications, such as:

IM **141**;

Image management **144**;

Camera **143**;

Weather **149-1**;

Stocks **149-2**;

Books **142**;

Calendar **148**;

Alarm clock **149-4**;

Map **154**;

Notes **153**;

Settings **412**, which provides access to settings for device **100** and its various applications **136**; and

Online video module **155**, also referred to as YouTube (trademark of Google Inc.) module **155**.

FIG. **4**B illustrates an exemplary user interface on a device (e.g., device **300**, FIG. **3**) with a touch-sensitive surface **451** (e.g., a tablet or touchpad **355**, FIG. **3**) that is separate from the display **450** (e.g., touch screen display **112**). Although many of the examples which follow will be given with reference to inputs on touch screen display **112** (where the touch sensitive surface and the display are combined), in some embodiments, the device detects inputs on a touch-sensitive surface that is separate from the display, as shown in FIG. **4**B. In some embodiments the touch sensitive surface (e.g., **451** in FIG. **4**B) has a primary axis (e.g., **452** in FIG. **4**B) that corresponds to a primary axis (e.g., **453** in FIG. **4**B) on the display (e.g., **450**). In accordance with these embodiments, the device detects contacts (e.g., **460** and **462** in FIG. **4**B) with the touch-sensitive surface **451** at locations that correspond to respective locations on the display (e.g., in FIG. **4**B, **460** corresponds to **468** and **462** corresponds to **470**). In this way, user inputs (e.g., contacts **460** and **462**, and movements thereof) detected by the device on the touch-sensitive surface (e.g., **451** in FIG. **4**B) are used by the device to manipulate the user interface on the display (e.g., **450** in FIG. **4**B) of the multifunction device when the touch-sensitive surface is separate from the display. It should be understood that similar methods may be used for other user interfaces described herein.

User Interfaces and Associated Processes

Attention is now directed towards embodiments of user interfaces ("UI") and associated processes that may be implemented on an electronic device with a display and a touch-sensitive surface, such as device **300** or portable multifunction device **100**.

FIGS. **5**A-**5**C illustrate exemplary user interfaces for navigation and annotation of electronic documents in accordance with some embodiments. The user interfaces in these figures are used to illustrate the processes described below, including the processes in FIGS. **7**A-**7**D and FIG. **8**.

FIG. **5**A illustrates an exemplary user interface displaying a portion of an electronic document **502-1** on touch screen display **112**. FIG. **5**A also illustrates gestures with exemplary finger contacts (e.g., **505**, **507**, **509**, **511**, **513**, **515**, **517**, and **519**) detected on touch screen display **112**. It should be noted that the exemplary finger contacts (e.g., **505**, **507**, **509**, **511**, **513**, **515**, **517**, and **519**) do not need to be detected simultaneously. Indeed, the exemplary finger contacts are typically detected separately (i.e., when finger contact **505** is detected, typically none of finger contacts **507**, **509**, **511**, **513**, **515**, **517**, and **519** are simultaneously detected with finger contact **505**).

The exemplary finger contacts include finger contact **505** that is part of a single finger swipe-gesture (e.g., a right-swipe gesture). As illustrated, finger contact **505** is detected at a location that corresponds to text of the displayed electronic document **502-1**, in particular, at a location that corresponds to a beginning of the word "our."

In FIG. **5**A, the user interface also indicates that the displayed portion of the electronic document **502-1** corresponds to page **4** of the electronic document.

FIG. **5**B illustrates an exemplary user interface displaying the portion of the electronic document **502-1** on touch screen display **112** after a gesture made with a finger contact (e.g., **505**, **507**, or **509**) is performed. The portion of the electronic document **502-1** in FIG. **5**B includes annotation information, such as highlights **510-1**, **510-2**, and **510-3**. As used herein, the term highlight refers to a visual emphasis of a portion of text, such as a different background color, an underline, a text with a different color, an italicized text, and/or a text with bold font. The respective highlights **510-1**, **510-2**, and **510-3** are displayed in response to respective corresponding gestures illustrated in FIG. **5**A. For example, FIG. **5**B illustrates that, in response to detecting a gesture with movement of finger contact **505** from **505**-A to **505**-B, highlight **510-1** is added to the displayed portion of the electronic document **502-1**, in particular, to a portion that corresponds to the movement of finger contact **505** from **505**-A to **505**-B (e.g., "our fathers"). In some embodiments, finger contact **505** may move further (e.g., move toward the right-side of the figure along the first line of text in the displayed portion of the electronic document **502-1**), and highlight **510-1** may expand to include one or more additional words (e.g., "brought").

Returning to FIG. **5**A, finger contact **507**, which is part of a single finger right-swipe gesture, is detected at a location that corresponds to one or more key words or a key phrase (e.g., "all men are created equal"). The one or more key words are typically pre-selected words (by an author, publisher, or user). Similarly, a key phrase is typically a pre-selected phrase. As illustrated, the key phrase and key words (e.g., "civil war") may be visually emphasized with bold text. FIG. **5**B illustrates that, in some embodiments, in response to detecting a gesture with movement of finger contact **507** from **507**-A to **507**-B, highlight **510-2** is added to the displayed portion of the electronic document **502-1**, in particular to a portion that corresponds to the movement of finger contact **507** from **507**-A to **507**-B (e.g., "all men"). In some embodiments, highlight **510-2** is added regardless of whether location **507**-A corresponds to a beginning or a middle of the word "all," as long as location **507**-A corresponds to a word in the one or more key words or the key phrase.

Returning to FIG. **5**A, the exemplary finger contacts include finger contact **509** that is part of a single finger right-swipe gesture. Finger contact **509** is detected at a location that corresponds to a beginning of a sentence and a beginning of a paragraph. FIG. **5**B illustrates that, in some embodiments, in response to detecting a gesture with movement of finger contact **509** from **509**-A to **509**-B, highlight **510-3** is added to the displayed portion of the electronic document **502-1**, in particular, to a portion of text that corresponds to the movement of finger contact **509** from **509**-A to **509**-B (e.g., "Now we are engaged in"). In some embodiments, in response to detecting a gesture with movement of finger contact **509** from **509**-A to **509**-B, another portion of the electronic document **502-2** is displayed on touch screen **112** (e.g., a prior portion of the electronic document (such as a preceding page **3**, not shown) when the speed of the movement of finger contact **509** exceeds a predefined speed threshold).

Also illustrated in FIG. **5**A is finger contact **511** that is part of a single finger left-swipe gesture. Finger contact **511** is detected at a location that corresponds to a beginning of a sentence and a beginning of a paragraph. In some embodiments, in response to detecting a gesture with the leftward movement of finger contact **511**, a navigation operation is performed, and as illustrated in FIG. **5**C, the next portion of the electronic document **502-2** is displayed on touch screen **112** (e.g., page **4** in FIG. **5**A is replaced by page **5** in FIG. **5**C).

Returning to FIG. **5**A, finger contact **513**, which is part of a single finger right-swipe gesture, is detected at a location that corresponds to an area between paragraphs, with no text. In some embodiments, in response to detecting the right-swipe gesture that includes finger contact **513**, a previous portion of the electronic document is displayed (e.g., page **3**, not shown).

FIG. **5**A also illustrates finger contact **515**, which is part of a single-finger left-swipe gesture at a location that corresponds to a margin of the displayed portion of the electronic document **502-1**. In some embodiments, in response to detecting the left-swipe gesture that includes finger contact **515**, the next portion of the electronic document **502-2** is displayed (e.g., page **5** in FIG. **5**C).

The exemplary finger contacts illustrated in FIG. **5**A include finger contact **517** that is detected at a location that corresponds to a location between two lines of text. In some embodiments, in response to detecting the gesture that includes finger contact **517**, a previous portion of the electronic document is displayed (e.g., page **3**, not shown).

FIG. **5**A also illustrates finger contact **519**, which is part of a single-finger left-swipe gesture, is detected on touch screen **112**. Finger contact **519** is detected at a location that corresponds to an end of a word, a sentence, or a paragraph. In some embodiments, in response to detecting a left-swipe gesture that includes finger contact **519**, the next portion of the electronic document **502-2** is displayed (e.g., page **5** in FIG. **5**C). In some embodiments, in response to detecting a left-swipe gesture that includes finger contact **519**, a portion of the displayed text (e.g., "do this") is highlighted instead of displaying the next portion of the electronic document (not shown).

FIG. **6** illustrates exemplary functions representing movements of respective finger contacts in respective gestures in accordance with some embodiments. In FIG. **6**, the movements of finger contacts (e.g., **505**, FIG. **5**A) are illustrated as functions of d (a distance between an initial position and a subsequent position of a finger contact, such as a distance between **505**-A and **505**-B) over time (represented as t) in plot **600**. Such functions are illustrated as lines in FIG. **6**. However, it should be noted that the lines in FIG. **6** are not drawn to scale.

Plot **600** includes lines **620**-*a* and **620**-*b* representing two values (e.g., two speeds) of a dynamic disambiguation threshold. The dynamic disambiguation threshold may initially have a default value (e.g., a speed corresponding to the slope of line **620**-*a*), and later adjust to an increased value (e.g., a speed corresponding to the slope of line **620**-*b*). Conversely, the dynamic disambiguation threshold may initially have a different default value (e.g., the speed corresponding to the slope of line **620**-*b*) and later adjust to a decreased value (e.g., the speed corresponding to the slope of line **620**-*a*).

Plot **600** includes line **602** representing a movement of a finger contact at a speed below a first threshold (e.g., the slope of line **620**-*a*). The slope of line **602** represents the speed of the movement of the finger contact, and the slope of line **602** is less steep than the slope of threshold line **620**-*a*. Line **602** represents a slow movement of a finger contact.

Plot **600** also includes line **604** representing a movement of a finger contact at a speed above the first threshold (e.g., the slope of line **620**-*a*) but below a second threshold (e.g., the slope of line **620**-*b*). The slope of line **604** is steeper than the slope of line **620**-*a*, and less steep than the slope of line **620**-*b*. Line **604** represents a moderate movement speed of a finger contact.

Also illustrated in plot **600** is line **606**, which represents a movement of a finger contact at a speed above the second threshold (e.g., the slope of line **620**-*b*). The slope of line **606** is steeper than the slope of line **620**-*b*. Line **606** represents a fast movement speed of a finger contact.

FIG. **6** also illustrates line **608** which represents a delayed movement of a finger contact. For line **608**, a finger contact is initially detected on touch screen **112** without a substantial movement of the finger contact (e.g., less than 0.3, 0.5, or 1.0 cm) for a duration (e.g., t_d). Thereafter, a movement of the finger contact is detected on touch screen **112**. Line **608** represents a typical movement of a finger contact for an annotation operation in an electronic document, where a user typically makes a careful initial contact at a particular location in the text and then starts to move the contact over the text to be highlighted. In contrast, during a navigation operation, such as a swipe gesture to change the page in an electronic document, the initial contact is typically already moving (at t=0) because careful placement of the finger is not needed. In some cases, a flicking movement (e.g., a short burst with an accelerated movement) of a finger contact is used for a navigation operation in an electronic document.

FIGS. **7**A-**7**D are flow diagrams illustrating method **700** of using a dynamic disambiguation threshold to interpret a gesture in accordance with some embodiments. Method **700** is performed at an electronic device (e.g., device **300**, FIG. **3**, or portable multifunction device **100**, FIG. **1**) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method **700** may be combined and/or the order of some operations may be changed.

As described below, method **700** provides a more accurate way to interpret a gesture. The method reduces the cognitive burden on a user when providing user gestures on a touch-sensitive surface, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, interpreting user gestures more efficiently and more accurately conserves power and increases the time between battery charges.

In some embodiments, the device displays an electronic document on the display (e.g., a portion of an electronic document **502-1**, FIG. **5**A). In some embodiments, the electronic document includes a plurality of document pages, and a respective portion of the electronic document corresponds to a respective document page. In some embodiments, a respective portion of the electronic document corresponds to a portion of a respective document page (but not the entire respective document page). In some embodiments, the electronic document is a continuous, scrollable document, with or without page breaks.

The device detects (**702**) a first portion of a gesture (e.g., an initial portion of the gesture). For example, the device detects one of: finger contacts **505**, **507**, **509**, **511**, **513**, **515**, **517**, and **519** (FIG. **5**A).

The device determines (**704**) that the first portion of the gesture has a first gesture characteristic (e.g., a location, predefined displacement/velocity/acceleration curve, direction, or speed). In some embodiments, the device determines that a

finger contact is detected at a location that does not correspond to any text (e.g., **513** or **515**, FIG. **5**A). For example, the device may determine that a finger contact is detected at a location between two paragraphs (e.g., **513**, FIG. **5**A), or at a location that corresponds to a margin of the displayed portion of the electronic document (e.g., **515**, FIG. **5**A). In some embodiments, the device determines that a finger contact is detected at a location that corresponds to a respective word (e.g., **505**, **507**, **509**, **511**, or **519**, FIG. **5**A). In some embodiments, the device determines that a finger contact is detected at a location that corresponds to a first word of a respective sentence (e.g., **509** or **511**, FIG. **5**A). In some embodiments, the device determines that a finger contact is detected at a location that corresponds to a last word of a sentence (e.g., **519**, FIG. **5**A). In some embodiments, the device determines that a finger contact is detected at a location that corresponds to the beginning of a respective word. For example, the finger contact **505** is detected at a location that corresponds to the beginning of the word "our," and the finger contact **511** is detected at a location that corresponds to the beginning of the word "Four." In some embodiments, the device determines that a finger contact is detected at a location that corresponds to a first word of a key phrase. For example, the finger contact **507** is detected at a location that corresponds to the first word of the phrase "all men are created equal." In some embodiments, the device determines that a finger contact is detected at a location between two lines of text (e.g., **517**, FIG. **5**A).

In some embodiments, a user interface that includes at least a portion of an electronic document (e.g., a book, a word processing document, a spreadsheet, a slideshow document, a webpage, etc.) is displayed (**706**, FIG. **7**B) on the display. Determining whether the first portion of the gesture has a first gesture characteristic includes determining whether the first portion of the gesture is detected at a location on the touch-sensitive surface that corresponds to a navigation preferred region of the displayed user interface (e.g., a margin of the displayed portion of the electronic document, as compared to a location that corresponds to an annotation preferred region of the displayed user interface, such as text of the electronic document). Navigation preferred regions are initial contact locations (e.g., margins and other locations without text or other content) that are more likely to correspond to navigation gestures (e.g., page turning or scrolling) rather than annotation gestures (e.g., highlighting). Conversely, annotation preferred regions are initial contact locations (e.g., locations that include text or particular types of text) that are more likely to correspond to annotation gestures rather than navigation gestures.

In some embodiments, the electronic document includes (**708**) content (e.g., text, images, figures, annotations, etc.), and the navigation preferred regions are regions that exclude content of the electronic document. For example, margins of the document (e.g., a location corresponding to finger contact **515**, FIG. **5**A) are navigation preferred regions.

In some embodiments, the electronic document includes (**710**) a plurality of paragraphs of text, and the navigation preferred regions are regions that are defined in accordance with locations of the plurality of paragraphs in the displayed user interface. For example, spaces between paragraphs (e.g., a location corresponding to finger contact **513**, FIG. **5**A).

In some embodiments, the electronic document includes (**712**) a plurality of lines of text, and the navigation preferred regions are regions that are defined in accordance with locations of the plurality of lines of text in the displayed user interface (e.g., spaces between the lines of the document are navigation preferred regions, such as a location corresponding to finger contact **517**, FIG. **5**A).

In some embodiments, a user interface that includes at least a portion of an electronic document (e.g., a book, a word processing document, a spreadsheet, a slideshow document, a webpage, etc.) is displayed (**714**) on the display, and determining whether the first portion of the gesture has a first gesture characteristic includes determining whether the first portion of the gesture is detected at a location on the touch-sensitive surface that corresponds to an annotation preferred region of the displayed user interface (as compared to the navigation preferred region described above).

In some embodiments, the electronic document includes (**716**) a plurality of words having a grammatical structure, and the annotation preferred regions are regions that are defined in accordance with the grammatical structure of the electronic document (e.g., the beginnings of clauses, sentences, paragraphs and other features identified by punctuation are annotation preferred regions). For example, locations corresponding to finger contacts **509** and **511**, the beginnings of sentences and/or the beginnings of paragraphs, are annotation preferred regions. As another example, a location corresponding to finger contact **507**, a beginning of a clause or phrase, is an annotation preferred region.

In some embodiments, the electronic document includes (**718**) a plurality of words, and the annotation preferred regions are regions that are defined in accordance with locations of the plurality words in the displayed user interface (e.g., the beginnings of words are annotation preferred regions). For example, locations corresponding to finger contacts **505** and **511** are the beginnings of words (FIG. **5**A).

In some embodiments, the electronic document includes (**720**) a plurality of terms including one or more emphasized terms, and the annotation preferred regions are regions that are defined in accordance with locations of the emphasized terms in the displayed user interface (e.g., bullet points, bolded text, etc. are annotation preferred regions). For example, a location corresponding to finger contact **507** (FIG. **5**A), which has emphasized terms (e.g., bolded text) "all men are created equal," is an annotation preferred region.

In some embodiments, determining whether the first portion of the gesture has a first gesture characteristic includes (**722**, FIG. **7**C) determining whether the first portion of the gesture has a speed that is greater than a predefined speed threshold. For example, when a user tries to navigate to a next portion of the electronic document, the gesture may have an initial speed that is greater than the predefined speed threshold (e.g., line **606** in FIG. **6** has an initial speed that is greater than the speed threshold **620**). In contrast, when the user tries to annotate, the gesture may be slow (e.g., line **602**, FIG. **6**) or initially relatively stationary as the user tries to carefully select the word to annotate (e.g., line **608** with an initial speed that is less than the speed threshold **620**-*a*).

In some embodiments, determining whether the first portion of the gesture has a first gesture characteristic includes (**724**) determining whether the first portion of the gesture has acceleration that is greater than a predefined acceleration threshold. For example, when the user tries to navigate to the next portion of the electronic document, the gesture may have acceleration that is greater than the predefined acceleration threshold. In contrast, when the user tries to annotate, the gesture may have little or no acceleration (e.g., lines **602** in FIG. **6** has an initial acceleration that is less than the acceleration threshold).

In some embodiments, determining whether the first portion of the gesture has a first gesture characteristic includes determining whether the first portion of the gesture has a

speed that is greater than the predefined speed threshold and acceleration that is greater than the predefined acceleration threshold.

In some embodiments, determining whether the first portion of the gesture has a first gesture characteristic includes (**726**) determining whether the first portion of the gesture includes movement of a contact that matches a predefined movement profile. For example, the predefined movement profile is a curve that corresponds to a change in displacement/velocity/acceleration over time (e.g., lines **602**, **604**, **606**, and **608** in FIG. **6**), and the movement matches the predefined movement profile when the rate of change of displacement/velocity/acceleration of the contact on the touch-sensitive surface over time is within 10% or 20% of the displacement/velocity/acceleration defined by the predefined movement profile. In some embodiments, determining whether the first portion of the gesture includes movement of a contact that matches a predefined movement profile includes determining whether the first portion of the gesture includes an initial pause of at least a predefined duration (e.g., t_d for line **608**, FIG. **6**).

In some embodiments, determining whether the first portion of the gesture has the first gesture characteristic includes (**728**) determining whether the first portion of the gesture has a component of movement in a predefined direction (e.g., to the right, left, or downwards).

In some embodiments, the first type of operation is (**730**) a navigation operation, and the second type of operation is an annotation operation. A user interface including at least a portion of a document that includes text is displayed on the display, and the predefined direction is a reading direction for the text (e.g., a primary reading direction, such as left-to-right for English text, right-to-left for Hebrew text, and top-to-bottom for traditional Japanese text). In accordance with a determination that the first portion of the gesture has a component of movement in the predefined direction, the dynamic disambiguation threshold is adjusted to increase the range of values (e.g., speed values, acceleration, pause, etc.) that correspond to the annotation operation. In other words, if a gesture is detected that has a component of movement in the reading direction, the dynamic disambiguation threshold is adjusted to increase the likelihood that the gesture will be interpreted as an annotation gesture (e.g., because users are more likely to annotate in a reading direction). For example, as illustrated in FIG. **5**A, the reading direction for the displayed English text is left-to-right. In response to detecting a left-to-right movement of finger contact **509**, the speed threshold is adjusted to increase the range of values that correspond to the annotation operation (e.g., in FIG. **6**, the slope of threshold line **620** is increased so that a wider range of speed corresponds to the annotation operation). Concurrently, in response to detecting a left-to-right movement of finger contact **509**, the speed threshold is adjusted to decrease the range of values (e.g., speed values) that correspond to the navigation operation.

In some embodiments, in accordance with a determination that the first portion of the gesture has a component of movement in a direction that is opposite to the predefined direction, the dynamic disambiguation threshold is adjusted (**732**) to increase the range of values that correspond to the navigation operation. In other words, if a gesture is detected that has a component of movement opposite to the reading direction, the dynamic disambiguation threshold is adjusted to increase the likelihood that the gesture will be interpreted as a navigation gesture (e.g., because users are less likely to annotate in a direction that is opposite to the reading direction, and are thus more likely to be using the gesture to navigate through the document). For example, when the reading direction is left-to-right, in response to detecting a right-to-left movement of finger contact **519**, the speed threshold is adjusted to decrease the range of values (e.g., speed values) that correspond to the annotation operation (e.g., in FIG. **6**, the slope of threshold line **620** is decreased so that a narrower range of speed corresponds to the annotation operation). In some embodiments, the dynamic disambiguation threshold is adjusted so that an annotation operation will not be performed (e.g., by reducing the range of values that correspond to the annotation operation to an empty set). Concurrently, in response to detecting a right-to-left movement of finger contact **519**, the speed threshold is adjusted to increase the range of values (e.g., speed values) that correspond to the navigation operation.

In some embodiments, the predefined direction is determined (**734**) in accordance with a language of the text (e.g., left-to-right for English text, right-to-left for Hebrew text, and top-to-bottom for traditional Japanese text).

In some embodiments, the first gesture characteristic is determined (**736**) in accordance with previous inputs detected by the device. In other words, the rules for defining navigation characteristics and annotation characteristics are learned from detected user behavior. For example, when a user performs multiple navigation operations with rapid movements of finger contacts (e.g., movements corresponding to line **606**, FIG. **6**), the speed threshold is increased above a default value in some embodiments (e.g., from line **620**-*a* to line **620**-*b*, FIG. **6**). Similarly, other user behavior may be used to adjust the first gesture characteristic (e.g., a particular user always performs an annotation operation with an initial finger contact at a location that corresponds to a middle of a paragraph).

In response to determining that the first portion of the gesture has a first gesture characteristic, the device selects (**738**, FIG. **7**A) a dynamic disambiguation threshold (e.g., speed and/or acceleration threshold) in accordance with the first gesture characteristic. The dynamic disambiguation threshold is used to determine whether to perform a first type of operation (e.g., a navigation operation) or a second type of operation (e.g., an annotation operation) when a first kind of gesture (e.g., a right-swipe gesture) is detected. As one example, the dynamic disambiguation threshold may include a speed threshold and/or an acceleration threshold selected in accordance with a location of the first portion of the gesture. In another example, the dynamic disambiguation threshold may include the speed threshold and the acceleration threshold selected in accordance with a speed of the first portion of the gesture.

In some embodiments, the device selects a high speed threshold when the first portion of the gesture is detected at an annotation preferred region of the displayed user interface. In some embodiments, the device selects a low speed threshold when the first portion of the gesture is detected at a navigation preferred region of the displayed user interface.

In some embodiments, the first kind of gesture is (**740**) a single contact swipe gesture. In some embodiments, the first kind of gesture is one of: a left-swipe gesture, a right-swipe gesture, a swipe-up gesture, and a swipe-down gesture. In some embodiments, the first kind of gesture is one of: a pinch gesture, a depinch gesture, a multi-contact swipe gesture, a single tap gesture, a multiple tap gesture.

In some embodiments, the dynamic disambiguation threshold is (**742**) a gesture speed threshold (e.g., the dynamic disambiguation threshold corresponds to a predefined speed of movement of the contact on the touch-sensitive surface during the gesture).

In some embodiments, the dynamic disambiguation threshold has (**744**) a default disambiguation value (e.g., the default disambiguation value is a default speed threshold for the movement of the contact).

The device determines (**746**) that the gesture is a gesture of the first kind of gesture. For example, the device determines that the gesture is a right-swipe gesture including a finger contact (e.g., **505**, **507**, **509**, or **517**). Alternatively, the gesture is determined to be one of: a left-swipe gesture; a swipe-up gesture; a swipe-down gesture; a pinch gesture; or a depinch gesture. In some embodiments, when the gesture is not a gesture of the first kind of gesture, the device processes the gesture without using the dynamic disambiguation threshold.

After selecting the dynamic disambiguation threshold, the device determines (**748**) whether the gesture meets the dynamic disambiguation threshold. In some embodiments, the device has a plurality of operational modes, including an annotation mode and a navigation mode, and the dynamic disambiguation threshold is used in only a subset of the operational modes. For example, the dynamic disambiguation threshold may be ignored when the device is in a navigation mode and used when the device is in an annotation mode.

In some embodiments, a second portion of the gesture is detected (**750**) after the first portion of the gesture (i.e., the second portion of the gesture is subsequent to the first portion of the gesture) and prior to determining that the gesture is a gesture of the first kind of gesture. The second portion of the gesture is used to determine whether the gesture meets the dynamic disambiguation threshold. For example, the first portion is a contact detected at an initial location on the touch-sensitive surface and the second portion includes subsequent movement of the contact on the touch-sensitive surface, and the dynamic disambiguation threshold is a speed threshold. Thus, the second portion of the gesture is used to determine a speed of the gesture, which enables the device to determine whether the speed of the gesture is greater than or less than the dynamic disambiguation threshold. For example, line **608** in FIG. **6** has a first portion that is substantially stationary, and a second portion that represents a movement at a respective speed, and the speed of the second portion may be used to determine whether the gesture meets the dynamic disambiguation threshold.

In accordance with a determination that the gesture meets the dynamic disambiguation threshold (e.g., a contact movement speed threshold), the device performs (**752**) the first type of operation in accordance with the gesture. For example, in response to detecting a swipe gesture that is faster than a speed threshold (e.g., line **604** in FIG. **6**), the device navigates through a displayed electronic document. In some embodiments, when the swipe gesture is a left swipe gesture above the dynamic disambiguation threshold, the device displays a next portion (e.g., a next page) of the electronic document (e.g., page **5**, FIG. **5**C), and when the swipe gesture is a right swipe gesture above the dynamic disambiguation threshold, the device displays a previous portion (e.g., a previous page) of the electronic document.

In accordance with a determination that the gesture does not meet the dynamic disambiguation threshold, the device performs (**754**) the second type of operation in accordance with the gesture. For example, in response to detecting a swipe gesture that is slower than a speed threshold (e.g., line **602** in FIG. **6**), the device adds highlighting to a portion of an electronic document in accordance with the gesture (e.g., highlight **510**, FIG. **5**B).

In some embodiments, the first type of operation is (**756**)) a navigation operation for an electronic document displayed on the display, and the second type of operation is an annotation operation for the electronic document. The first gesture characteristic is a navigation characteristic (e.g., the first portion of the gesture is located in a navigation preferred region, has a navigation preferred direction, etc.). In accordance with a determination that the gesture has the first gesture characteristic, the dynamic disambiguation threshold is adjusted to increase the range of values that correspond to the navigation operation. For example, when a finger contact is detected at a location that corresponds to a margin of a displayed portion of the electronic document (e.g., finger contact **515**, FIG. **5**A), the speed threshold (e.g., as illustrated by the slope of line **620**, FIG. **6**) is decreased to increase the range of speeds that corresponds to the navigation operation.

In some embodiments, a user interface that includes a current portion of the electronic document is displayed (**758**) on the display, and the navigation operation includes displaying a different portion of the electronic document in the user interface in accordance with the gesture. As one example, the device replaces the currently displayed page of the electronic document with a next page of the electronic document. In another example, the device scrolls a next portion of the electronic document in one or two dimensions.

In some embodiments, the first type of operation is (**760**) a navigation operation for an electronic document displayed on the display, and the second type of operation is an annotation operation for the electronic document. The first gesture characteristic is an annotation characteristic (e.g., that the first portion of the gesture is located in an annotated preferred region, or has an annotation preferred direction, etc.). In accordance with a determination that the gesture has the first gesture characteristic, the dynamic disambiguation threshold is adjusted to increase the range of values that correspond to annotation operation. For example, when a finger contact is detected at a location that corresponds to text of a displayed portion of the electronic document (e.g., finger contact **509**, FIG. **5**A), the speed threshold (e.g., as illustrated by the slope of line **620**, FIG. **6**) is increased to increase the range of speeds that corresponds to the annotation operation (e.g., from line **620**-*a* to line **620**-*b*, FIG. **6**).

In some embodiments, a user interface that includes at least a portion of the electronic document having predefined content is displayed (**762**) on the display, and the annotation operation includes adding additional content to the predefined content. For example, a swipe over a line of text adds highlighting (or an underline) to the line of text. In some embodiments, information corresponding to annotations is stored in metadata for the document, and the method includes, in conjunction with adding a new annotation, modifying the information corresponding to the annotations that is stored in the metadata for the document to account for the new annotation. In other words, an annotation such as highlighting is not merely transient "selection" of a portion of the document. Rather, information corresponding to the annotation is stored in metadata for the document and is available for later use. Thus, storing the annotation in the metadata for the document allows closing and retrieving the document, and displaying the annotation stored in the metadata for the document. In some embodiments, the annotation is also referred to as a persistent annotation.

In some embodiments, the first type of operation navigates to a next or previous page of an electronic document, and the second type of operation navigates to a next or previous chapter of the electronic document. For example, a speed threshold is selected in accordance with an initial location of a finger contact. When a gesture includes movement of the finger contact at a speed below the speed threshold, the device navigates to a next or previous page of the electronic docu-

ment. When the movement of the finger contact in the gesture has a speed above the speed threshold, the device navigates to a next or previous chapter of the electronic document.

In some embodiments the first type of operation navigates to a next or previous page of an electronic document, and the second type of operation navigates to a page that includes a table of contents for the electronic document. When a gesture includes movement of the finger contact at a speed below the speed threshold, the device navigates to a next or previous page of the electronic document. When the movement of the finger contact in the gesture has a speed above the speed threshold, the device navigates to the page that includes the table of contents.

In some embodiments, the gesture is a pinch gesture. In some embodiments, the first type of operation is a zoom-in operation, and the second type of operation is an annotation operation (e.g., annotating a portion of text between two finger contacts for the pinch gesture).

In some embodiments, the gesture is a depinch gesture. In some embodiments, the first type of operation is a zoom-out operation, and the second type of operation is an annotation operation (e.g., annotating a portion of text between two finger contacts for the pinch gesture, or expanding an area covered by an existing annotation).

FIG. **8** is a flow diagram illustrating method **800** of interpreting a gesture as a navigation gesture or an annotation gesture for an electronic document in accordance with some embodiments. Method **800** is performed at an electronic device (e.g., device **300**, FIG. **3**, or portable multifunction device **100**, FIG. **1**) with a display and a touch-sensitive surface. In some embodiments, the display is a touch screen display and the touch-sensitive surface is on the display. In some embodiments, the display is separate from the touch-sensitive surface. Some operations in method **800** may be combined and/or the order of some operations may be changed.

As described below, method **800** provides a more accurate and more efficient way to interpret a gesture as a navigation gesture or an annotation gesture for an electronic document. The method reduces the cognitive burden on a user when providing a gesture for a navigation operation or an annotation operation for an electronic document, thereby creating a more efficient human-machine interface. For battery-operated electronic devices, providing a more accurate and more efficient way to interpret a gesture as a navigation gesture or an annotation gesture conserves power and increases the time between battery charges.

The device displays (**802**) at least a portion of an electronic document (e.g., a book, a word processing document, a spreadsheet, a slideshow document, a webpage, etc.) that includes text that has a reading direction. For example, for English, the reading direction is left-to-right, and for Hebrew the reading direction is right-to-left. In FIG. **5**A, the displayed portion **502-1** includes English text that has the left-to-right reading direction.

The device detects (**804**) a gesture (e.g., a swipe gesture) on the touch-sensitive surface. The gesture includes movement (of at least one finger contact) in a first direction on the touch-sensitive surface that corresponds to a second direction on the display (e.g., the direction for the movement of contact **460** on the touch-sensitive surface **451** corresponds to the direction of the corresponding location **468** on the display **450**, FIG. **4**B). In some embodiments, the first direction on the touch-sensitive surface is the same as the second direction on the display, such as when the display is a touch-sensitive display that includes the touch-sensitive surface.

In response to detecting the gesture (**806**), in accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, the device performs (**808**) a navigation operation (e.g., turning a page in the document or scrolling through the document to display a different portion of the document). As one example, when the direction of the movement is right-to-left (e.g., movement of a finger contact, such as one of **511**, **515**, and **519** on page **4**, FIG. **5**A), the device displays a next portion of the document (e.g., page **5**, FIG. **5**C). In another example, in response to detecting a diagonal left-up swipe, the device displays the next portion of the document **502-2**, because the diagonal left-up swipe has a directional component (e.g., right-to-left) that is opposite to the reading direction (e.g., left-to-right). Thus, even when the direction of the swipe does not exactly align with the opposite of the reading direction, the device displays the next portion of the document (e.g., page **5**, FIG. **5**C).

Also in response to detecting the gesture (**806**), in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria, the device performs (**810**) an annotation operation (e.g., highlighting text). In some embodiments, when the second direction has a directional component in the reading direction but the gesture does not meet predefined criteria, then a navigation operation is performed. The predefined criteria may be based on a location of the gesture, a speed of the gesture, etc. For example, in response to detecting a movement of finger contact **505** at a location that corresponds to text (FIG. **5**A), the device performs an annotation operation (e.g., **510-1**, FIG. **5**B). In response to detecting a movement of finger contact **513** at a location that does not correspond to text (FIG. **5**A), the device performs a navigation operation (e.g., displaying the next portion of the electronic document **502-3**, FIG. **5**C).

Note that details of other processes described herein with respect to method **700** are also applicable in an analogous manner to method **800**. For example, the navigation operation and annotation operation described with reference to FIG. **8** may have one or more of the characteristics of the various navigation operations and annotation operations described herein with reference to method **700**. For brevity, these details are not repeated here.

As described herein, the disambiguation is used for distinguishing the navigation operation and the annotation operation (e.g., highlighting). The disambiguation could also be used for distinguishing the navigation operation and a text selection operation.

The operations in the information processing methods described above may be implemented by running one or more functional modules in information processing apparatus such as general purpose processors or application specific chips. These modules, combinations of these modules, and/or their combination with general hardware (e.g., as described above with respect to FIGS. **1**A and **3**) are all included within the scope of protection of the invention.

The operations described above with reference to FIGS. **7**A-**7**D and FIG. **8** may be implemented by components depicted in FIGS. **1**A-**1**B. For example, detection operation **702**, selection operation **738**, and performing operation **754** may be implemented by event sorter **170**, event recognizer **180**, and event handler **190**. Event monitor **171** in event sorter **170** detects a contact on touch-sensitive display **112**, and event dispatcher module **174** delivers the event information to application **136-1**. A respective event recognizer **180** of application **136-1** compares the event information to respective event definitions **186**, and determines whether a first contact

at a first location on the touch-sensitive surface corresponds to a predefined event or sub-event, such as selection of an object on a user interface. When a respective predefined event or sub-event is detected, event recognizer **180** activates an event handler **190** associated with the detection of the event or sub-event. Event handler **190** may utilize or call data updater **176** or object updater **177** to update the application internal state **192**. In some embodiments, event handler **190** accesses a respective GUI updater **178** to update what is displayed by the application. Similarly, it would be clear to a person having ordinary skill in the art how other processes can be implemented based on the components depicted in FIGS. **1A-1B**.

In accordance with some embodiments, FIG. **9** shows a functional block diagram of an electronic device **900** configured in accordance with the principles of the invention as described above. The functional blocks of the device may be implemented by hardware, software, or a combination of hardware and software to carry out the principles of the invention. It is understood by persons of skill in the art that the functional blocks described in FIG. **9** may be combined or separated into sub-blocks to implement the principles of the invention as described above. Therefore, the description herein may support any possible combination or separation or further definition of the functional blocks described herein.

As shown in FIG. **9**, an electronic device **900** includes a display unit **902**; a touch-sensitive surface unit **904** configured to detect a first portion of a gesture; and a processing unit **906** coupled to the display unit **902** and the touch-sensitive surface unit **904**. In some embodiments, the processing unit **906** includes a determining unit **908**, a selecting unit **910**, a first performing unit **912**, a second performing unit **914**, a display enabling unit **916**, an adjusting unit **918**, and an adding unit **920**.

The processing unit **906** is configured to: determine that the first portion of the gesture has a first gesture characteristic (e.g., with the determining unit **908**); in response to determining that the first portion of the gesture has a first gesture characteristic, select a dynamic disambiguation threshold in accordance with the first gesture characteristic (e.g., with the selecting unit **910**), wherein the dynamic disambiguation threshold is used to determine whether to perform a first type of operation or a second type of operation when a first kind of gesture is detected on the touch-sensitive surface unit **904**; determine that the gesture is a gesture of the first kind of gesture (e.g., with the determining unit **908**); after selecting the dynamic disambiguation threshold, determine whether the gesture meets the dynamic disambiguation threshold (e.g., with the determining unit **908**); in accordance with a determination that the gesture meets the dynamic disambiguation threshold, perform the first type of operation in accordance with the gesture (e.g., with the first performing unit **912**); and in accordance with a determination that the gesture does not meet the dynamic disambiguation threshold, perform the second type of operation in accordance with the gesture (e.g., with the second performing unit **914**).

In some embodiments, the first kind of gesture is a single contact swipe gesture.

In some embodiments, the dynamic disambiguation threshold is a gesture speed threshold.

In some embodiments, the dynamic disambiguation threshold has a default disambiguation value.

In some embodiments, a second portion of the gesture is detected (e.g., with the touch-sensitive surface unit **904**) after the first portion of the gesture and prior to determining that the gesture is a gesture of the first kind of gesture; and the second portion of the gesture is used to determine (e.g., with the determining unit **908**) whether the gesture meets the dynamic disambiguation threshold.

In some embodiments, the first type of operation is a navigation operation for an electronic document displayed on the display unit **902**, and the second type of operation is an annotation operation for the electronic document. The first gesture characteristic is a navigation characteristic, and in accordance with a determination that the gesture has the first gesture characteristic, the dynamic disambiguation threshold is adjusted (e.g., with the adjusting unit **918**) to increase the range of values that correspond to the navigation operation.

In some embodiments, a user interface that includes a current portion of the electronic document is displayed on the display unit **902**; and the navigation operation includes enabling display of a different portion of the electronic document in the user interface in accordance with the gesture (e.g., with the display enabling unit **916**).

In some embodiments, the first type of operation is a navigation operation for an electronic document displayed on the display unit **902**, and the second type of operation is an annotation operation for the electronic document. The first gesture characteristic is an annotation characteristic, and in accordance with a determination that the gesture has the first gesture characteristic, the dynamic disambiguation threshold is adjusted (e.g., with the adjusting unit **918**) to increase the range of values that correspond to the annotation operation.

In some embodiments, a user interface that includes at least a portion of the electronic document having predefined content is displayed on the display unit **902**, and the annotation operation includes adding additional content to the predefined content (e.g., with the adding unit **920**).

In some embodiments, a user interface that includes at least a portion of an electronic document is displayed on the display unit **902**, and determining whether the first portion of the gesture has the first gesture characteristic includes determining (e.g., with the determining unit **908**) whether the first portion of the gesture is detected at a location on the touch-sensitive surface unit **904** that corresponds to a navigation preferred region of the displayed user interface on the display unit **902**.

In some embodiments, the electronic document includes content, and the navigation preferred regions are regions that exclude content of the electronic document.

In some embodiments, the electronic document includes a plurality of paragraphs of text, and the navigation preferred regions are regions that are defined in accordance with locations of the plurality of paragraphs in the displayed user interface.

In some embodiments, the electronic document includes a plurality of lines of text, and the navigation preferred regions are regions that are defined in accordance with locations of the plurality of lines of text in the displayed user interface.

In some embodiments, a user interface that includes at least a portion of an electronic document is displayed on the display unit **902**, and determining whether the first portion of the gesture has a first gesture characteristic includes determining whether the first portion of the gesture is detected at a location on the touch-sensitive surface unit **904** that corresponds to an annotation preferred region of the displayed user interface.

In some embodiments, the electronic document includes a plurality of words having a grammatical structure, and the annotation preferred regions are regions that are defined in accordance with the grammatical structure of the electronic document.

In some embodiments, the electronic document includes a plurality of words; and the annotation preferred regions are

regions that are defined in accordance with locations of the plurality words in the displayed user interface.

In some embodiments, the electronic document includes a plurality of terms including one or more emphasized terms, and the annotation preferred regions are regions that are defined in accordance with locations of the emphasized terms in the displayed user interface.

In some embodiments, determining whether the first portion of the gesture has the first gesture characteristic includes determining whether the first portion of the gesture has a speed that is greater than a predefined speed threshold.

In some embodiments, determining whether the first portion of the gesture has the first gesture characteristic includes determining whether the first portion of the gesture has acceleration that is greater than a predefined acceleration threshold.

In some embodiments, determining whether the first portion of the gesture has a first gesture characteristic includes determining whether the first portion of the gesture includes movement of a contact that matches a predefined movement profile.

In some embodiments, determining whether the first portion of the gesture has the first gesture characteristic includes determining whether the first portion of the gesture has a component of movement in a predefined direction.

In some embodiments, the first type of operation is a navigation operation, and the second type of operation is an annotation operation. A user interface including at least a portion of a document that includes text is displayed on the display unit **902**. The predefined direction is a reading direction for the text. In accordance with a determination that the first portion of the gesture has a component of movement in the predefined direction, the dynamic disambiguation threshold is adjusted (e.g., with the adjusting unit **918**) to increase the range of values that correspond to the annotation operation.

In some embodiments, in accordance with a determination that the first portion of the gesture has a component of movement in a direction that is opposite to the predefined direction, the dynamic disambiguation threshold is adjusted (e.g., with the adjusting unit **918**) to increase the range of values that correspond to the navigation operation.

In some embodiments, the predefined direction is determined (e.g., with the determining unit **908**) in accordance with a language of the text.

In some embodiments, the first gesture characteristic is determined (e.g., with the determining unit **908**) in accordance with previous inputs detected by the device.

In accordance with some embodiments, FIG. **10** shows a functional block diagram of an electronic device **1000** configured in accordance with the principles of the invention as described above. The functional blocks of the device may be implemented by hardware, software, or a combination of hardware and software to carry out the principles of the invention. It is understood by persons of skill in the art that the functional blocks described in FIG. **10** may be combined or separated into sub-blocks to implement the principles of the invention as described above. Therefore, the description herein may support any possible combination or separation or further definition of the functional blocks described herein.

As shown in FIG. **10**, an electronic device **1000** includes a display unit **1002** configured to displaying at least a portion of an electronic document that includes text that has a reading direction on the display unit, and a touch-sensitive surface unit **1004** configured to detect a gesture. The gesture includes movement in a first direction on the touch-sensitive surface unit that corresponds to a second direction on the display unit **1002**. The electronic device **1000** also includes a processing unit **1006** coupled to the display unit **1002** and the touch-sensitive surface unit **1004**. In some embodiments, the processing unit **1006** includes a determining unit **1008**, a navigation operation unit **1010**, and an annotation operation unit **1012**. The processing unit **1006** is configured to, in response to detecting the gesture: in accordance with a determination (e.g., with the determining unit **1008**) that the second direction on the display unit **1002** includes a directional component that is opposite to the reading direction, perform a navigation operation (e.g., with the navigation operation unit **1010**); and in accordance with a determination (e.g., with the determining unit **1008**) that the second direction on the display unit **1002** includes a directional component in the reading direction and that the gesture meets predefined criteria, perform an annotation operation (e.g., with the annotation operation unit **1012**).

The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. However, the illustrative discussions above are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications, to thereby enable others skilled in the art to best utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated.

What is claimed is:

1. A method performed at an electronic device having a display and a touch-sensitive surface, comprising:

displaying at least a portion of an electronic document that includes text that has a reading direction on the display;

detecting a gesture on the touch-sensitive surface, wherein the gesture includes movement in a first direction on the touch-sensitive surface that corresponds to a second direction on the display; and

in response to detecting the gesture:

in accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, performing a navigation operation on the electronic document; and

in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria relating to a location on the touch sensitive surface or a speed of the gesture, performing an annotation operation on the electronic document.

2. The method of claim **1**, further comprising:

in response to detecting the gesture:

in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture does not meet the predefined criteria, performing a navigation operation on the electronic document.

3. An electronic device, comprising:

a display;

a touch-sensitive surface;

one or more processors;

memory; and

one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the one or more programs including instructions for:

displaying at least a portion of an electronic document that includes text that has a reading direction;

detecting a gesture on the touch-sensitive surface, wherein the gesture includes movement in a first direction on the touch-sensitive surface that corresponds to a second direction on the display; and

in response to detecting the gesture:

in accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, performing a navigation operation on the electronic document; and

in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria relating to a location on the touch sensitive surface or a speed of the gesture, performing an annotation operation on the electronic document.

4. A non-transitory computer readable storage medium storing one or more programs, the one or more programs comprising instructions, which when executed by an electronic device with a display and a touch-sensitive surface, cause the device to:

display at least a portion of an electronic document that includes text that has a reading direction;

detect a gesture on the touch-sensitive surface, wherein the gesture includes movement in a first direction on the touch-sensitive surface that corresponds to a second direction on the display; and

in response to detecting the gesture:

in accordance with a determination that the second direction on the display includes a directional component that is opposite to the reading direction, perform a navigation operation on the electronic document; and

in accordance with a determination that the second direction on the display includes a directional component in the reading direction and that the gesture meets predefined criteria relating to a location on the touch sensitive surface or a speed of the gesture, perform an annotation operation on the electronic document.

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